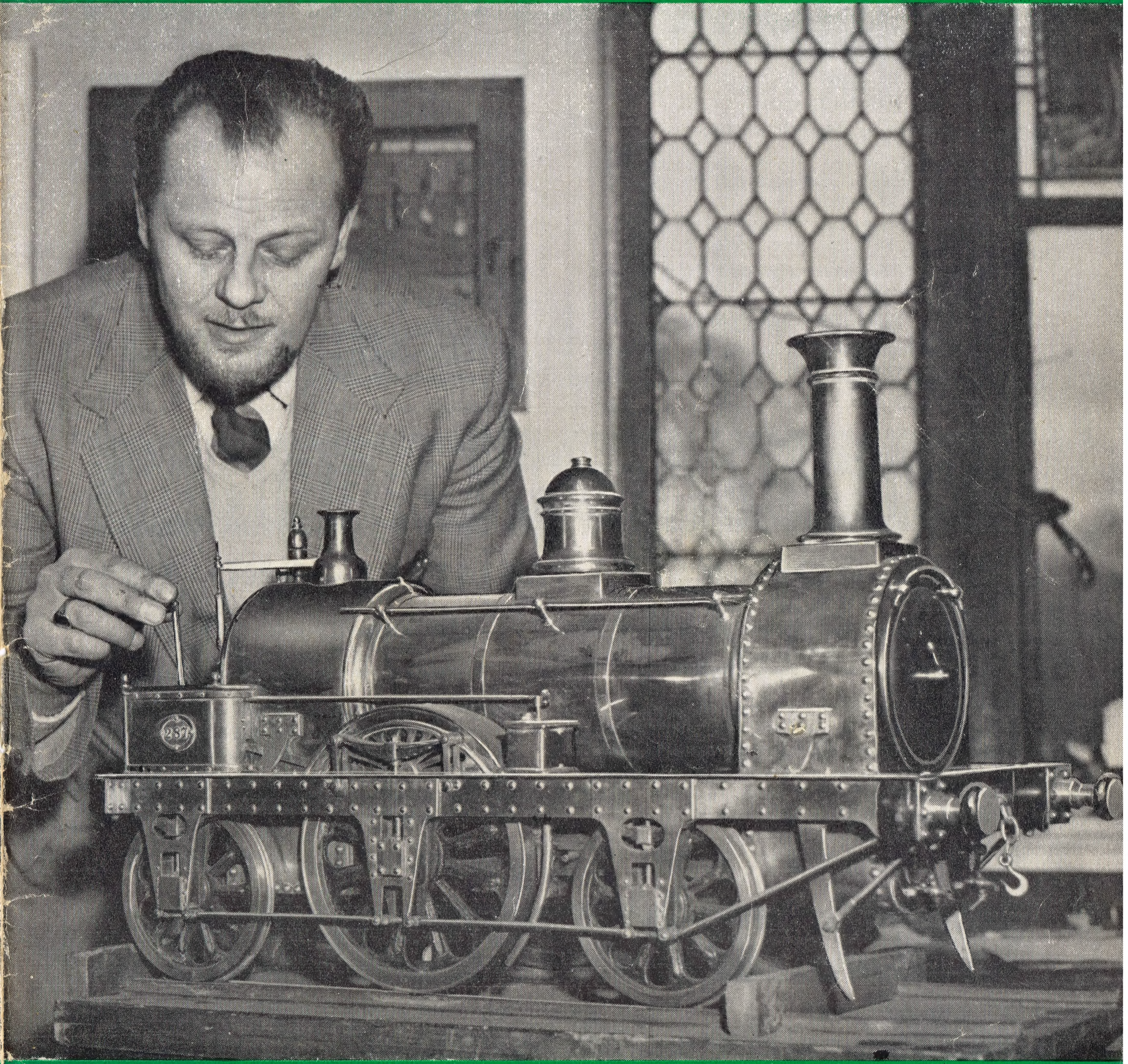
Model Engineer

THE MAGAZINE FOR THE MECHANICALLY MINDED



ONE SHILLING 31 JULY 1958 VOL 119 NO 2984

Model Engineer Exhibition

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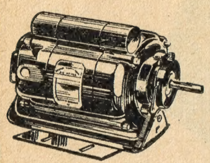

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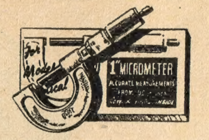

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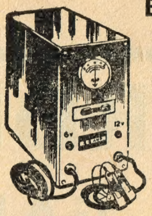

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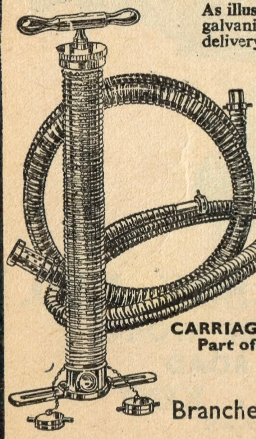

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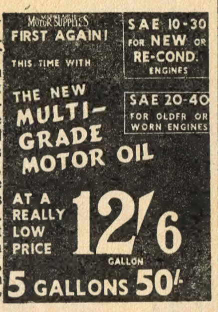

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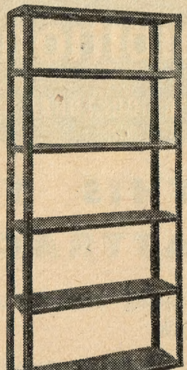

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Model Engineer

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Preview of the Exhibition
Early Hawthorn locomotives
Drill chuck modification
Adjustable-height toolholder

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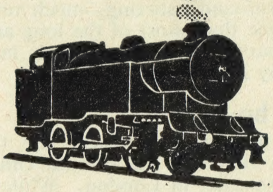
Smoke Rings

By VULCAN



I WAS surprised to learn from some of my friends in the clubs that they look on the heading " In the ME Workshop " as not representing the literal position. Let me assure them that the heading to the weekly feature means just what it says. All the work which is described in that feature is carried out on the premises at Noel Street, a stone's throw from Oxford Circus.

The workshop is not as large as it has been at various times in the history of Percival Marshall. As older readers will no doubt recall, the ME workshop was used at one time for lessons in model engineering, and in it were produced the models on which constructional articles were based.

At the present time it is not used educationally; its two occupants are fully engaged on constructional work which is afterwards the subject of articles in the pages of MODEL ENGINEER. I often consult Martin Evans and Exactus and never fail to be fascinated by the progress of *Jubilee*, the 3½ in. gauge locomotive which is being built with meticulous care. It will not be finished in time for this year's ME Exhibition but it will certainly be on show as far as it has gone.

The mighty frame

" HEREAFTER, when they come to model Heaven and calculate the stars, how they will wield the mighty frame." The cosmology of Milton, by present standards, was primitive; but his vision of the universe, though physically bound to the concepts of his time, comes amazingly close to the vision now being revealed to us by the latest astronomy.

We know, for instance, that our own local galaxy, one among innumerable others, contains 100,000,000,000 stars more or less, and that light travelling at 186,000 miles a second takes two million years to reach us from the great nebula of Andromeda, the nearest nebula to our little world.

Science has restored the Miltonic splendour. The old phrases and images can be re-interpreted. " How they will wield the mighty frame," Milton wrote: and we have a mighty frame today at Jodrell Bank in Cheshire.

Chance to pioneer

Jodrell Bank radio-telescope is a great feat of engineering as well as of science. Before it could be planned or fully envisaged, Professor A. C. B. Lovell of Manchester University, the astronomer who leapt into the headlines with the first sputnik, took his problems to Mr H. C. Husband, a Sheffield consulting engineer [" The Way to the Stars," ME for 7 July 1946]. They were tremendous problems; but Mr Husband saw them as an opportunity. Here was a chance to pioneer.

What Professor Lovell wanted was a steerable telescope as big as St Paul's and yet so constructed that the strongest wind would not deflect its aim more than a fraction of a degree.

Such is the radio-eye which looks out from Jodrell Bank into the unimaginable unknown. Built on concrete piles driven through 90 ft of subsoil to solid rock, it turns with mathematical precision on a central pivot—nearly 2,000 tons of metal moving like the mechanism of a wrist-watch.

Quarter-mile railway

In one of its devices, electronic apparatus which keeps it focused on a chosen point as the earth goes round, are gearwheel trains producing a reduction of two million to one. The railway at the base is a quarter of a mile long on a 5 ft concrete track

levelled to $\frac{1}{16}$ in.: an accuracy of one in fifteen thousand.

Like all men of true achievement, Mr Husband is a friendly and modest person—as I discovered when he came to London for a private view of *The Inquisitive Giant*, a film in which Professor Lovell co-stars with the telescope. I found *The Inquisitive Giant* profoundly stirring—much more of an epic than most of the long and noisy narratives which are so mis-called by Hollywood.

May be hired

The film was produced for the Foreign Office by the Central Office of Information in London. While it is primarily designed to tell other countries of a great British engineering feat, the COI sees no reason why it should not tell England as well; and so you may hire a copy for your own showing. A 16 mm. print costs 15s. for the first day and 3s. for each succeeding day until the eighth, when the charge of 15s. recurs. Alternatively the film may be bought outright.

In Britain and overseas the modelling clubs are seeing more movies than ever before. They will, I think, enjoy *The Inquisitive Giant*.

Write to me, if you wish, for further details.

Modern Ireland

MANY railway enthusiasts to whom I have spoken seem to be under the impression that the Irish Railways, or to give them their correct title, Córas Iompair Efreann, are hopelessly out-of-date compared with British Railways.

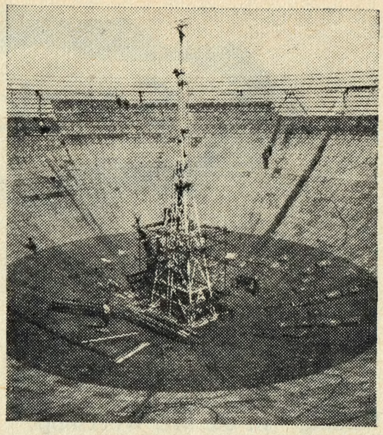
This belief might have been somewhere near the mark ten years ago, when Eire provided a delightful feast for the narrow-gauge and branch line addict, and time was the servant rather than the master of the Irish engineman.

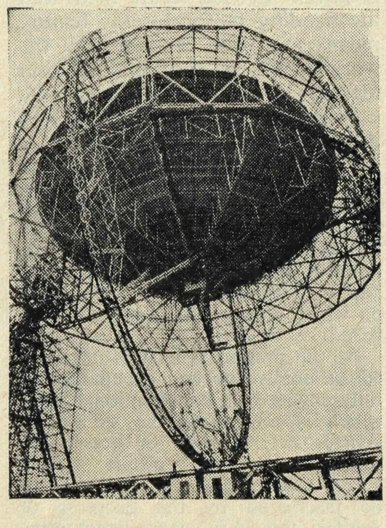
But today, the Eire transport system, thanks to the decision of its board four years ago to replace most of their older steam locomotives by the latest diesel-electric types, can claim to be thoroughly up-to-date.

Impressive order

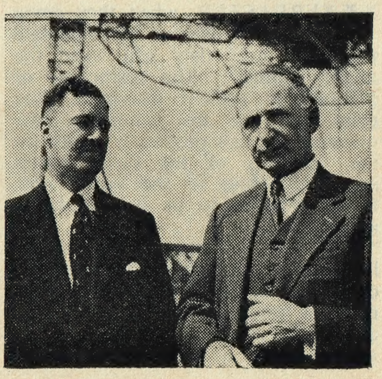
In May 1954, Córas Iompair Efreann, the national transport body of the Republic of Eire, placed a contract for the purchase of 94 diesel-electric locomotives from Metropolitan Vickers, 60 of which were to be of the Co-Co type, of 1,200 b.h.p. and the remaining 34 Bo-Bo 550 b.h.p.

Few people realised at the time that this order, which was completed a few weeks ago, indicated a conversion from steam traction to diesel service on a scale which even the USA cannot equal.





Top: Engineers, displaying a fly-like aptitude, at work on the 250 ft dia. bowl of the telescope. Centre: Underneath the huge bowl, and, below, Mr H. C. Husband (left) designer of the telescope with Professor A. Lovell of Manchester



Cover picture

Mr Kenneth Wilson, lecturer and guide to Leeds Schools at Kirkstall Abbey House Museum, examining the model engine made by Thomas Dixon and recently presented to the Museum by his granddaughter. An article on his model is on pages 141 *and* 142.

The railway system in Eire comprises for the most part 5 ft 3 in. gauge trackwork, although there are about 160 miles of 3 ft gauge in West Claire, Cavan and Leitrim. Altogether the track extends to about 2,010 miles.

Faster timings

The new diesel-electrics were completed with the assistance of such well-known organisations as Crossley Brothers, who supplied the diesel engines, the Metropolitan-Cammell Carriage and Wagon Co., and the English Steel Corporation.

Depots to handle these locomotives have been completed at Inchicore (Dublin), Limerick, Cork and Waterford, the former containing the main repair shop, while the latter handle routine servicing and cleaning only.

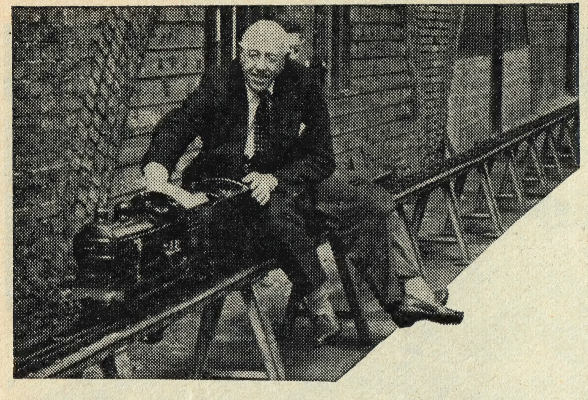
Improvements in the scheduled timings have been brought about by the use of these new locomotives, particularly on the main lines. The 165 mile Dublin-Cork run is now made in 3 hours 5 mins., including a stop at Limerick Junction, while the timings of the faster goods trains between these cities have been cut by as much as 80 to 100 minutes.

Edward Kay

MR EDWARD KAY, well known in the Lancashire district, has died suddenly at the age of 57.

Mr Kay, who was a regular reader of MODEL ENGINEER since the "Battle of the Boilers," was a great admirer of LBSC and an ardent live-steam enthusiast. At the time of his unexpected death he had almost completed a 5 in. gauge locomotive which, along with several other models, had kept him busy since his partial retirement a few years ago.

Teddy, as he was familiarly known to his model engineering friends, was a judge for the live-steam section of the Southport exhibition and was well known for his ready laugh, cheery face and the willing advice which was always forthcoming from his rich store of knowledge.



The Earl of Northesk, president of SMEE, is a keen live steamer

JOSEPH MARTIN visits the SMEE Diamond Jubilee Exhibition . . . and a pioneer who remembers

The first sixty years

"ALTHOUGH these intimations of support are perhaps hardly as numerous as we should like, they are certainly sufficient to warrant our arranging for a preliminary meeting to be held as promised. We accordingly have pleasure in inviting all readers who are interested in this matter to attend a meeting in the reading room attached to our publishing offices at 6, Farringdon Avenue, London. . . ."

Herbert Hildersley, a London apprentice, read this announcement in the tenth issue of MODEL ENGINEER. Six days later, on the first Tuesday in October, he made his way to Farringdon Avenue, paid a shilling, and became a founder member of what is now the Society of Model and Experimental Engineers.

Still young at heart

With that shilling, the eager apprentice of 1898 bought the key to riches—to interests, enthusiasms and friendships which have been among the chief good fortunes of his long life. The white-haired octogenarian whom I met the other day at Hither Green, on the Kent side of London, was still a young man at heart. Sixty years had passed since SMEE was founded, but whenever I spoke of SMEE, of models and modellers, I felt that Mr Hildersley, for all the frailty of age, was still the youthful enthusiast who paid his shilling to Percival Marshall on an October evening in the London of Queen Victoria.

Even then Herbert Hildersley was quite a veteran among modellers. "I began when I was four," he told me. "My first model was of an engine made from a piece of tree trunk with four slices cut off for the wheels. The chimney was a wooden peg and I bored the hole with a red-hot poker. I can still remember the smell."

For a few moments, Mr Hildersley was back in 1881, the year that Disraeli died. Then he crossed the room to a glass-fronted cabinet by the window and brought me a tiny model locomotive, a Great Northern express engine at a scale of 5/64 in. "When I was 20," he said, "I built my own lathe, and one of the first things I made on it was this."

At that time the GNR engine was a contemporary piece of engineering; today the model represents an antique. In particular I was charmed by the tiny spokes of the wheels, delicately shaped in brass. "Ah, yes," chuckled Mr Hildersley. "I made them walking along the street in the dinnertime."

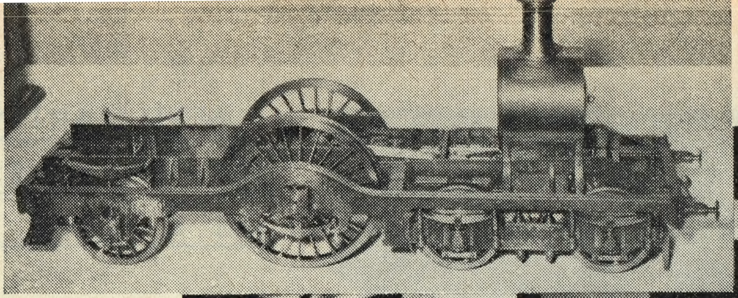
The same delicacy of detail was present in his other little treasures from the cabinet: in the Zeppelin fashioned from a piece of the famous prototype brought down in flames near Potters Bar; in the bicycle which he modelled when he was 15; and in the snuff-box with its trick lock (set originally to the hour and date of his son's birth) which first baffled his friends just half a century ago.

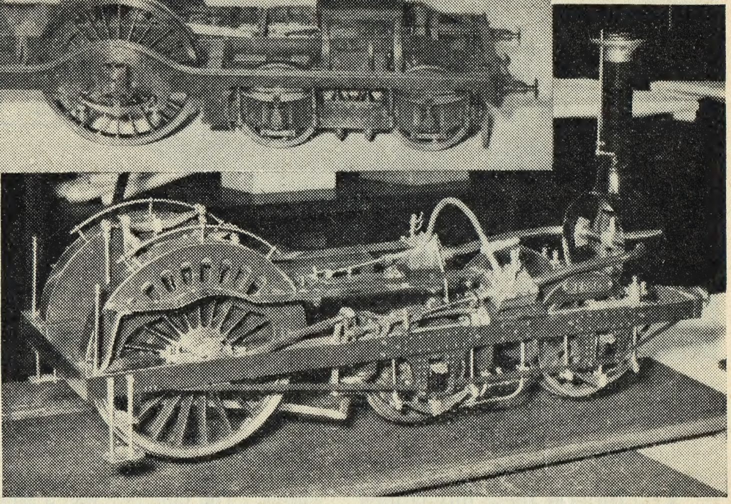
Mr Hildersley has made all kinds of things from a little grandfather clock in wood to the calendar clock which he considers his masterpiece; from a horizontal steam engine to an electric motor which will still work after 54 years. "I have often stayed up at night on the last day of February," he said. "On every occasion the calendar clock behaved perfectly."

One fine work Mr Hildersley has not yet completed: a shining 12 in. howitzer as finely made as his elegant microscope and the master-clock in the hall. He hopes to finish it soon. At 80 a man likes to sit in the sun sometimes—but nobody wants to laze about all day when he has a workshop handy and all sorts of jobs to be done.

SMEE picture of the opening by Lord Northesk. Standing in the corner, secretary S. L. Sheppard listens intently

Two locos under construction. A Dean Single and (below) the ERGO





"This used to be the sitting room," said Mrs Hildersley, standing by the lathe which her husband built when he was 20.

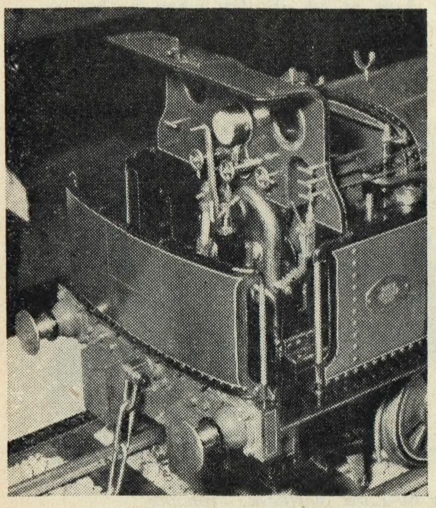
"I've stood in it more than I've sat!" said Mr Hildersley.

There, among his treasures, I left him. Herbert Hildersley, son of a cabinet maker, belongs to the great tradition of craftsmanship. Not for nothing was he chosen to repair and renovate the wonderful clocks of the Wallace Collection; not for nothing has he a store of awards, kept in a secret place behind a secret lock of his own devising. He has the eye, the touch, the instinct, of the workshop artist, the man who will not let anything pass from his hands until it is as near perfect as his great skill and care can make it.

This is the tradition which the Society of Model and Experimental Engineers has fostered through 60 years. If Herbert Hildersley had gone to the SMEE headquarters in Wanless Road, London, for the Society's Diamond Jubilee Exhibition he would have felt even prouder of being one of the surviving founder members, with Mr H. Sanderson, a director of the Stuart Turner company, and Mr A. M. Yule, who lives in Hertfordshire.

It was a quiet, absorbing exhibition: a display of spectacular craftsmanship modestly displayed. My attention was immediately caught by three model locomotives in a row: the LMS tank, winner of an ME bronze medal, by S. T. Harris; the LBSCR Terrier *Leadenhall* by H. V. Steele; and the LMS 0-6-0 dock shunter which A. A. Smith built to the description in these pages by J. I. Austen-Walton.

Add P. J. Dupen's 0-4-0 contractor's engine *Lord Mayor* which won the ME Championship Cup in 1950, the Alexander Allan *Crewe* of 1851 by D. H. Harris, the *Small Bass* of LBSC by C. W. Tidy, the Dean Single chassis by D. G. Webster, and the Crampton 1 in. scale passenger locomotive under construction by D. H. Harris. These, with J. G. Archer's traction engine, were a delight to lovers of live steam on rail and road.



P. J. Dupen built the LORD MAYOR

Only one ship

From K. N. Harris came a horizontal single-cylinder engine originally built to demonstrate the Greenly valve gear; from Colonel D. H. Chaddock an experimental flash-steam turbine and a little gas turbine of the inward radial flow type, with centrifugal compressor. Edgar T. Westbury was represented indirectly by W. Linfield's *Unicorn* engine, which is an ETW design, and directly by examples of his work in an ME loan collection which included his diagonal paddle engines. Another diagonal paddle engine, winner of an ME Championship Cup, had been brought from the Science Museum in tribute to the late A. W. Marchant. But, while there were paddle engines, I could find only one ship: a motor trawler which earned L. G. Warner a bronze medal.

C. B. Reeve is a member of SMEE, and a selection of his clocks in the society's library made the place an Aladdin's cave for admirers of his loving and lovely skill. In the same room stood the Santa Fe locomotive by the late James Crebbin, a memorial to a great SMEE craftsman of the past.

Besides having the use of all the tools in the headquarters workshops, SMEE members make tools of their own. Here, with impressive work from D. C. Harben, W. Linfield and others, was a $2\frac{1}{2}$ in. lathe with driving attachment, every bit of it made by H. S. Weston.

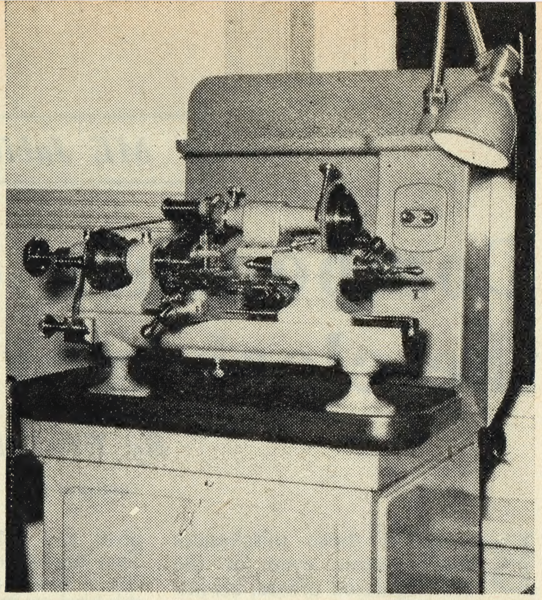
Quality first

The tradition of SMEE rests on standards. Wherever one looked at this Diamond Jubilee Exhibition—at W. Linfield's microscope or the patterns and parts for W. A. Carter's GN Atlantic locomotive, at the clocks or the hot-air engines, or the little 4-4-0 engine by Herbert Philpot, among the cakes and teacups where Mrs Philpot presided: wherever one looked one received the satisfaction of sheer quality. It was present almost dazzlingly in a marine engine commemorating the late Comdr W. T. Barker, and in A. H. Nettleton's Congreve clock.

Finally Mr E. C. Yalden, who preceded Mr S. L. Sheppard as secretary, showed me W. H. Dearden's gas engine which in 1900 won the society's first gold medal for a competition entry. The late Mr Dearden built it on a home-made lathe in 1898—the year when he and Herbert Hildersley made their way through the October evening to see what was happening at 6 Farringdon Avenue. ■

Some memories of
THE SMEE

By J. N. Maskelyne



Lathe, stand and light: H. S. Weston built the whole of it

THE Diamond Jubilee of SMEE brings memories of my own association with the society and its members. From early childhood I have been keenly interested in models, more especially model steam locomotives; but in earlier days the models left a great deal to be desired, and I spent much of my spare time studying the problem of making them look and behave more like their prototypes. At that time I was handicapped by not knowing any other model engineers with whom I could discuss my ideas. As a sedulous reader of *The Model Engineer and Practical Electrician*, I was convinced that there were plenty of people who would listen to me, if I could only meet them.

Among my colleagues at a later period was the late C. S. Barrett, an expert model engineer. It was he who persuaded me, in 1917, to join SMEE where I found myself among the élite of model engineering for the first time. I came into close contact with the sort of work that these people could produce, and I made personal acquaintance with men whose names were already known to me from the pages of ME.

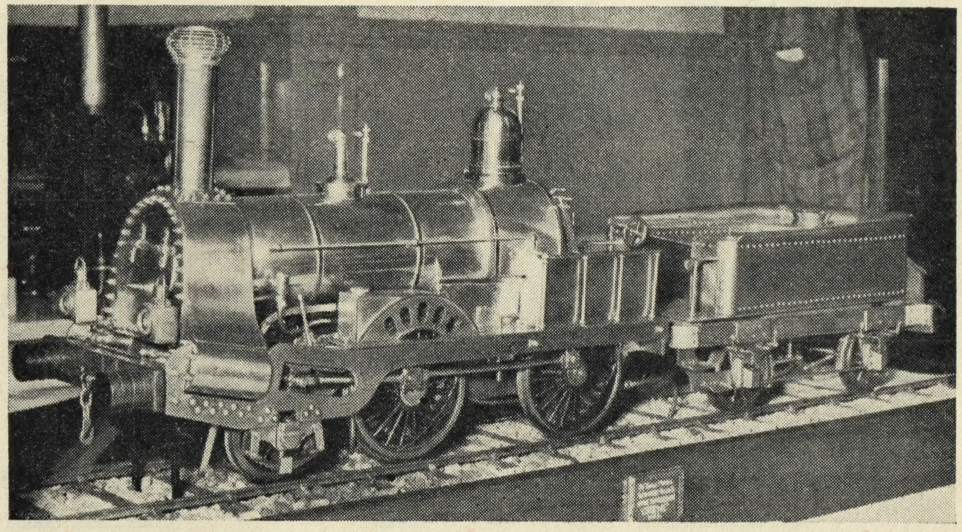
This seemed to be almost too good to be true, and for a while I was content to add to the number of new acquaintances and to admire their work. Then, in 1919, I was elected to the committee, an honour repeated in 1923 and 1927. In 1928 I was promoted to vice-chairman and, in the following year, to chairman. After that, I served for two years on the council.

All this occupied much of my time; but my reward was the foundation of personal friendships with such men as Percival Marshall, W. J. Bassett-Lowke, Stuart Turner, J. C. Crebbin, W. B. Hart, the brothers Willoughby, V. C. Storey, J. A. B. Graham, Dr Bradbury Winter, Dr A. C. Hovenden, C. M. Keiller, LBSC and many others to whom I am grateful for what I learned from them.

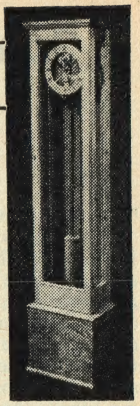
The many meetings of SMEE that I was able to attend were always profitable in some way or another, from the lectures at Caxton Hall to the practical demonstrations at the old workshop in Nassau Street. For some years I was a steward at the workshop, thereby gaining first-hand knowledge of the work on which members were engaged. Very often, this would bring up a topic for discussion; or a member would have a piece of work on which he wanted advice.

The greatest influence which SMEE has had on my life is the part that it played in my joining the editorial staff of Percival Marshall and Co. This meant that what had hitherto been an engrossing hobby became, for 21 years, my means of livelihood. Now, in my retirement, I am more than ever convinced that, if I had not joined SMEE in 1917, I might never have met Percival Marshall, or been invited to become associated with his magazines.

Because of all this, it is with great affection that I offer my most cordial congratulations to SMEE on its Diamond Jubilee, and my very best wishes for another 60 years of good work in furthering the cause of model engineering. ▣



This 1851 CREWE *by Dudley Harris won an ME medal*



Components of the clock movement

By EDGAR T. WESTBURY

Continued from 17 July 1958, pages 67 to 69

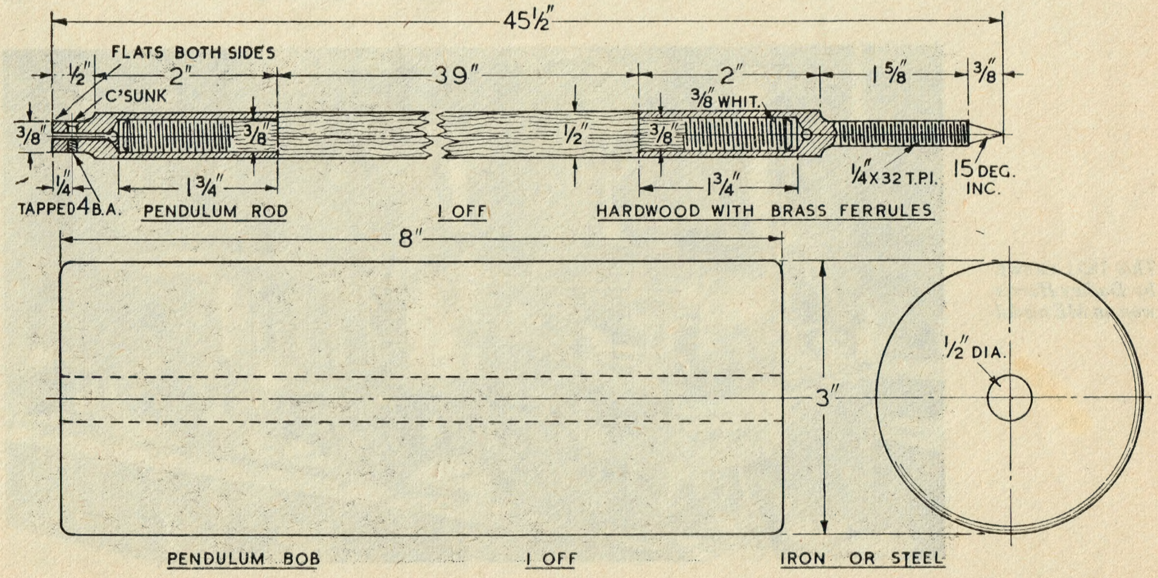
BY one of those mischances which occur even in the best-regulated offices, an important drawing was omitted from an earlier article in this series, namely, the details of the pendulum rod and bob, which should have accompanied the description of these items in the May 15 issue. I must admit that I had not noticed this omission until my attention was called to it by several readers. However, no harm has been done, as the drawing was soon found. It is reproduced here, with apologies for getting it out of normal sequence.

Pallet bridge

The fittings for the clock frame should next be made; the most important are the two outboard bearing brackets for the motion pivot and pallet arbor respectively. They follow normal horological practice in design and fitting; brackets of this kind are generally termed "cocks," though when the bracket extends both ways from the pivot centre, and is secured at both ends, the term " bridge " is more appropriate. They are usually made from castings, or cut from the solid; bent-up brackets, although serviceable, are liable to look rather slovenly, and are not favoured in any but the cheapest clocks.

In my case, the pallet bridge was machined from a piece of $\frac{5}{8}$ in. × $\frac{3}{8}$ in. brass bar, $1\frac{3}{4}$ in. long, and most of the unwanted material was removed in the lathe, by holding it crosswise in the four-jaw chuck, set up symmetrical to the centre both ways, at two separate settings for inside and outside surfaces respectively. The squaring-up of the gap, inside and out, was done by milling. It is possible to dispense with this further work if curved surfaces are not objected to, in which event the ends should be similarly finished by turning, so that they harmonise with the other curved surfaces. But this is not in keeping with orthodox clock practice, and I thought it best to conform with it by keeping to square edges. Needless to say, whatever design or methods of construction are adopted, the flat seatings of the bridge must be true and the pivot hole exactly square with them; finally, the fixing holes are drilled in the positions shown.

As the centre of the pallet arbor (so-called, as there are no pallets, in the true sense of the term, in this clock) does not bear any fixed relation to the gearing, the pivot holes may be drilled in the main clock plates in the position indicated, using the front plate as a jig for the other, as already described. To locate the bridge in its correct position for pivot alignment, a



straight piece of silver steel rod $\frac{1}{16}$ in. dia. may be passed through the holes in the two plates and the bridge, which is then held in position by clamps while spotting the tapping holes in the rear plate.

The fitting of dowels to ensure accurate location of the bridge is optional; I do not consider it necessary as the screws locate it near enough for practical purposes, so long as the clearance holes are not made unnecessarily large. Finally the hole in the rear clock plate is opened out to $\frac{5}{16}$ in. dia. to give ample clearance for the pallet arbor.

It may be remarked that this bridge might be dispensed with by pivoting the arbor in the two main plates, and extending the pivots on both sides as required. This, however, would not be very good practice, for two reasons; first it would entail tight fitting of both the crutch and the rocker on the outside of the plates, making assembly and dismantling more difficult, and second, because less adequate support to the crutch would be provided.

Motion cock

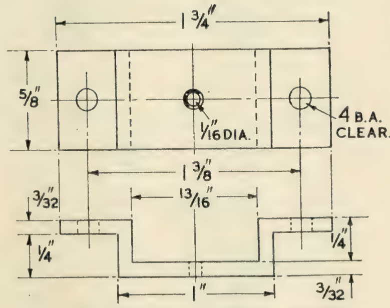
The motion cock was made by building up from 3/32 in. hard brass sheet, by silver soldering, as machining from the solid would entail a good deal of waste metal, and in any case no material of large enough section was readily available. In order to hold the three pieces of brass together during the brazing operation, both the vertical pieces were made longer than required, and the horizontal piece was provided with two dowels or tenons (filed from the solid) at each end; holes were drilled in the verticals to correspond, and the tenons, after insertion, riveted in. After brazing, the unwanted end projections were cut away and the job generally cleaned up.

As the pivot hole in this cock must line up with that in the front clock plate, the location of which depends on the meshing of the gear wheels, the cock cannot yet be fixed in position, though the fixing holes may be drilled in the foot, ready for spotting the tapping holes in the plate.

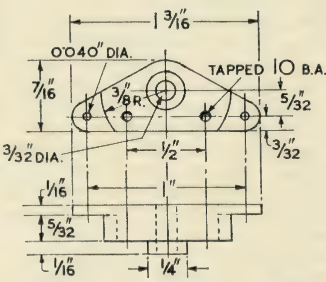
Rocker

This component carries the two gravity pawls which propel the ratchet wheel, and both accuracy and free working are highly important. It can be machined from a piece of $1\frac{1}{4}$ in. $\times$ $\frac{7}{16}$ in. brass bar, which should be long enough to hold in the four-jaw chuck, the position of the hole being marked out and set to run truly. The machining of the spigot, pivot lugs, and drilling of the centre hole can then be carried out at this setting.

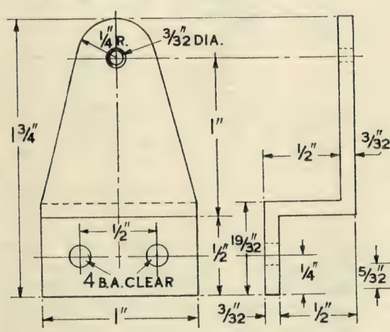
Before removing the job from the chuck, it is a good policy at this stage to mark out the holes for the pivots and the fixing screws. The chuck may then be removed bodily and laid on the drill table, and the holes drilled, taking them $\frac{1}{8}$ in. or so deeper than would normally be necessary. The pivot holes are, of course, left undersize for final finishing. If desired, the outer contour of the rocker may be shaped by milling or filing while still held in the chuck.



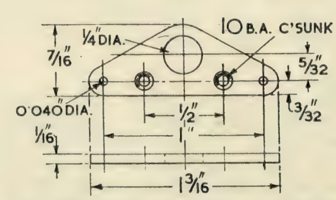
PALLET BRIDGE 1 OFF BRASS



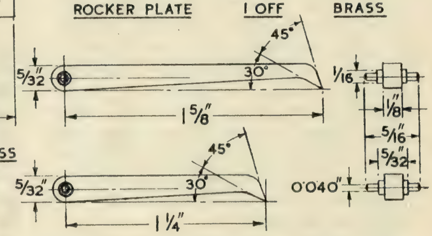
ROCKER 1 OFF BRASS



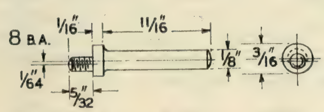
MOTION COCK 1 OFF BRASS



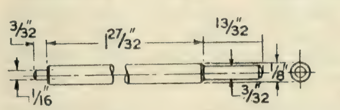
ROCKER PLATE 1 OFF BRASS



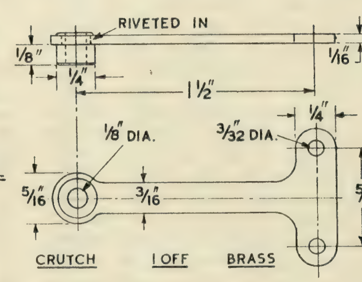
PAWLS 1 OFF EACH HARD STEEL



CRUTCH PIN 2 OFF STEEL



PALLET ARBOR 1 OFF SILVER STEEL



CRUTCH 1 OFF BRASS

The rocker may now be parted off with a keen parting tool. If drilled as directed, the rocker plate can also be produced, by opening out the centre hole and parting off a $\frac{1}{16}$ in. slice, with the pivot and fixing holes all ready drilled. After opening up and countersinking the latter, and tapping the holes in the rocker, the two parts may be fixed together, and a " reamer-burnisher," made as previously described, run through the pivot holes at both ends of the rocker assembly.

Pawls

These may be made either of silver steel, hardened throughout at the engaging end, or of mild steel case-hardened; either will give good service for quite a long time, but in the event of any subsequent refitting of the pawls entailing grinding or honing, it would be necessary to renew the " case " of the latter. If silver steel is used, it should be

quenched in water, polished up, and held by the tip end in tongs or pliers, for letting down the other end and most of the shank to a dark purple or blue, before re-quenching. The colouring enhances the appearance of the pawls and may be protected by a thin coat of lacquer, but this must be kept away from the tips and the pivots.

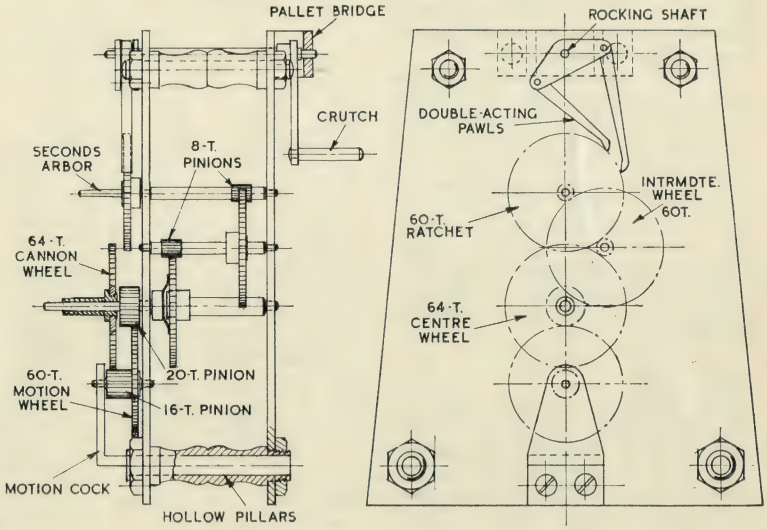
The pawls of electric clocks are often pivoted on fixed pins; but while this works fairly well in most cases, much better results are obtained by fitting double-ended pivots to the pawls, with bearings both sides. As shown, it is recommended that the pivots should be pressed into the pawls, and shoulders be provided to prevent the latter from rubbing on the sides of the bearing lugs. This form of pivot may be a little more difficult to make than the other, but it works with less friction and is adequately supported. The accurate chucking and turning down of two tiny pivots may be too much like watchmaking for some constructors; I find the best way is to turn them all over from larger material at one setting, using a narrow pointed tool, and polishing the pivots before finally parting off.

Crutch

The crutch is cut to shape from $\frac{1}{16}$ in. hard brass sheet, the eye being drilled $\frac{3}{16}$ in. to receive a shouldered collet, which is then riveted in, the hole being left slightly undersize for fitting. At the fork end, two steel crutch pins are fitted; it will be seen that the screwed ends of these are eccentric to the shanks, so that they can be adjusted exactly to fit the diameter of the pendulum rod, after which they are locked by 8 BA nuts. Note that if a metal pendulum rod is employed the design of the fork end will have to be modified to suit the different diameter.

The crutch is a press fit on the pallet arbor, in such a position that when the latter is assembled, it swings just clear of the back frame plate, allowing for the projecting crutch pin nuts. It is permissible to make the seating on the arbor slightly taper —not more than about one thou in its length—to facilitate fitting, and the same applies to the extended front end, which carries the rocker. The latter should not be too tight a fit, as its relation to the crutch must be capable of adjustment when setting up the clock; a tight wringing fit should be quite sufficient. Some constructors may prefer to use an easier fit, providing a setscrew for locking it when adjusted. These fitting operations call for some delicacy of touch, but they are common to all horological work, and the required skill can only be obtained by practice.

Some pains have been taken to work out the simplest possible combinations of wheels for this clock, not only to facilitate the work of those who undertake cutting their own gears, but also to improve the chances of being able to obtain suitable gears ready-made. As the loading of the gears is very light, and all motion is from a higher to a lower ratio, involute form gears, with which all engineers are familiar, are quite appropriate, though there is no objection to cycloidal or other recognised horological tooth forms. By adopting 40 diametral pitch, it is possible to use gears of very convenient size, and relatively small numbers of teeth, while the calculations for pitch and outside diameters are simplified, enabling round decimal figures to be used in all cases.



General arrangement of clock movement

The ratios

The gear ratio of 1 : 60 from the "minute" wheel—in this case the ratchet wheel—to the centre wheel is obtained in two stages, namely $\frac{8}{60} \times \frac{8}{64}$ or $7\frac{1}{2}$ to 1 $\times$ 8 to 1 reduction. A further two stages provide the ratio of 1 : 12 for the "motion" train which drives the hour hand, namely $\frac{60}{20} \times \frac{16}{64}$, or 3 to 1 $\times$ 4 to 1 reduction. Thus the complete wheelwork system involves the use of a minimum number of different gears, the full set (not counting the ratchet wheel) being two 60 t two 64 t, two 8 t pinions, and one each of 20 and 16 t. The pinions may conveniently be made from pinion wire, which is now obtainable in very accurate form, and thus it is only necessary to cut the 60 t and 64 t gears, which may be dealt with in pairs, so that only two separate operations are involved. For those who are not prepared to cut their own gears, I confidently expect to be able to announce that a full set of ready-cut gears will be available very shortly.

As the wheels and pinions, together with their arbors and pivots, follow normal clock practice, it is not considered necessary to describe them at great length. The articles on wheel cutting, by Mr J. C. Stevens, in the issues of ME 29 January, 5 and 12 February 1953, together with Mr C. B. Reeve's more recent articles on the ME Musical Clock, deal with these subjects far more competently than, with my limited experience of clockmaking, I could ever hope to do.

I would, however, encourage constructors to try their hand at wheel cutting, which is by no means as difficult as some of them believe, especially as in this particular clock, everything is of robust dimensions, and the extremely high precision required on many types of mechanically-driven clocks is not essential to a moderate degree of success, when electricity is used for motive power.

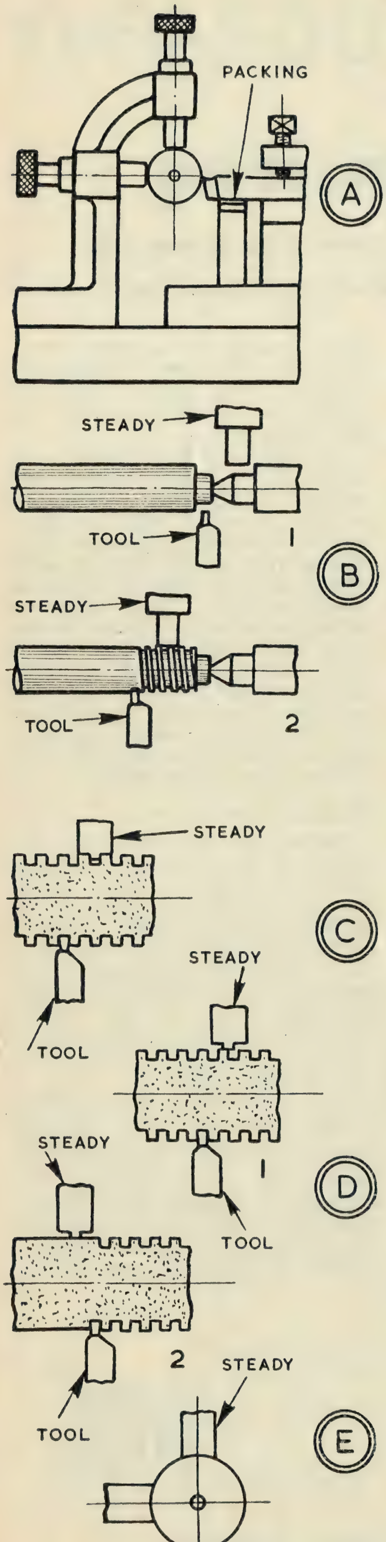
For those who do not wish to undertake this work, however, I have been able to get a stock of wheels cut to order and hope to arrange for their distribution through the model supply trade in the near future.

● *To be concluded on August 14*

By GEOMETER

WORKSHOP HINTS and TIPS

Screwcutting long threads



Long types of screw of square-thread or Acme form, for use as leadscrews, feedscrews, jackscrews—and for many similar purposes—present problems of production which do not occur in shorter varieties of screwed components. With the latter, there is usually no problem of support when the work can be held in a chuck or mounted on the faceplate; and even if the tailstock has to be used, a tool set-up can generally be arranged without difficulty.

It is otherwise with very long threads as, apart from anything else, the length demands use of the travelling steady close to the tool position —to obviate spring and wobble with the work pushing away from the tool on a normal depth of cut, and digging in when the cut is increased.

That is to say, as in ordinary turning, functions of the travelling steady are to keep the work turning truly, and to provide the rigid backing necessary to control depth of cut. On a long screw, too, with the tailstock close up, a fairly considerable forward overhang of the tool may be necessary for the topslide to pass along by the tailstock for beginning the cut. Because of the rather heavy cut normal for broad threads, the tool would be subject to spring and chatter, unless supported with packing between it and the cross-slide table, as at *A*.

Position of steady

Setting of the steady in relation to the tool can be important; and normally the two should not be directly opposite, as there is a good chance of swarf from the tool running round and getting between the work and the steady jaws—which would have the immediate effect of greatly increasing the depth of cut and possibly breaking the tool. Hence the steady is usually somewhat before or behind the tool.

Of course, a position before the tool is not practicable if the thread diameter is less than that of any plain portion or boss further along, as there would be a shoulder obstructing the steady jaws before the tool arrived at the end of the thread. With the steady positioned behind the tool, the tailstock alone supports the work at the start of the cut, as at *B*1; then, after the first few turns, the steady comes into action, as at *B*2, providing support to the end of the cut.

A number of cuts must be made to bring a square or Acme thread to depth, and after the first one the steady jaws are running on reduced support, touching only at the original diameter. With several cuts on long traverse, this can result in wear on the steady jaws, which become grooved from working always in the same relationship to the tool, as at *C*. It may be noticed by irregularities or difficulties in the cut, and by a " clicking " as the saddle is returned. On a one-off job, the effect may be slight and not occasion difficulty, though there are often points to watch.

Alteration of tool

Any alteration of the tool sideways, such as if it has to be removed and sharpened (which is best avoided, if possible, in the course of cutting a square-thread screw), may result in very thin edge support, as at *D*1, with impending variations in cut. If the steady runs before the tool, there will almost certainly be variations in cut with any type of grooving of the jaws. With the steady providing proper support, at position *D*2, there would be slack support on the thread; while firm support on the thread would give extra depth of cut at the position shown, with the possibility of tearing the work, or breaking the tool.

Given that the tool cuts freely, many difficulties can be avoided by ensuring the steady jaws are true, and bed on the work to maximum curvature, as at *E*. This demands preliminary machining, and truing when necessary, with a fly-cutter bar of work radius, adjusting the jaws and traversing the saddle, as otherwise the flat ends of the jaws would wear ridged. ■

HIGH-SPEED PHOTOGRAPHY

in engineering

GEOFFREY I. LILLEY reviews some of the systems used in the examination of fast-moving mechanisms and operations

ELECTRONIC flash—the flashlight that enables photographers to still the wings of humming birds, splashes of water, or the flying fragments of a broken tea-cup—plays a vitally important part in the testing of mechanical equipment and the development of manufacturing techniques.

In engineering, where operations are often extremely rapid, the advantages of high-speed photographic investigation are obvious enough, but the use of super-speed photography is by no means confined to the study of fast-moving mechanisms.

It is doubtful whether there is any field of technology where high-speed photography could not be usefully employed. Furthermore, it is probably true to say that the life of everyone is affected in some way or another by the results of high-speed photographic studies.

For example, the washing of a modern car is not so tedious as the cleaning of an older type, for the splashing of mud from car tyres has been studied. So also has the movement of suspension systems, starter mechanisms and, of course, the operation of the internal combustion engine itself.

Windows in engines

The occurrence of surging in valve springs; engine clatter; the faulty operation of cams and tappets—all are faults that may be successfully diagnosed by the correct application of rapid photography.

Several investigators have fitted windows to internal combustion engines and were thus able to produce photographs showing the cause of such things as pre-ignition and engine knock. Plugs have been photographed while sparking. One worker constructed a special high-speed cine camera for this particular application which was capable of taking pictures at the rate of 5,000 per second.

High picture speed may be regarded as an achievement in itself, but in practice some formidable obstacles have to be overcome. One of the biggest difficulties lies in the provision of adequate lighting. This is a problem which, in some applications, assumes alarming proportions.

Take, for example, the study of a small mechanism such as a watch. At first sight it would appear that ample light could be produced for such a small area. There is a complication, however. With very small objects it is necessary to work with long camera extensions and short lens-to-object distances. This reduces depth of focus to minute proportions and the lens has to be stopped down to compensate, so much greater illumination is required.

Troubles do not end here, however. It is most likely that the heat produced by the light will interfere with the normal running of the mechanism under investigation, and so the whole arrangement takes on the air of a vicious circle.

News flash

The placing of the lights presents a further problem. The lamps cannot be brought near enough to avoid deep shadows because the camera gets in the way, and so some system of reflectors has to be set up.

From the foregoing it will be clear that this is a highly specialised field and the possession of a basic knowledge of photography and an electronic flash lamp are hardly sufficient qualifications for making a start in it !

The production of photographs by means of short duration flashes is by no means new, for as long ago as 1851 Fox Talbot, the pioneer of modern photography, produced a spark photograph of a page of *The Times* while it was revolving on a disc.

In spite of the development of the gas-discharge tube there are still many applications where a spark provides the most satisfactory light source. Though sparks possess the disadvantage of emitting light mainly from the blue end of the spectrum, thus not taking full advantage of the sensitivity of modern photographic emulsions, they produce flashes of really short duration—say less than one micro-second.

The spark circuit is basically quite simple, but triggering devices may introduce complications. The amount of light is usually fairly low but it may be increased considerably by an arrangement of two gaps in series; one for the production of the lighting spark and the other, somewhat larger, for allowing a higher voltage to be used. This second gap can be used as a triggering device by adjusting the voltage so that the gap does not quite break down. A metal ball can be dropped through the larger gap to trigger the circuit and produce a fat spark at the shorter gap.

Registering shock waves

Sparks may be used as a light source for recording shock waves in air and a method has been devised for intensifying the shadows, the Schlieren technique (Fig. 1), which is of considerable value in studies of such things as carburation. This system has been subjected to several modifications and it is now possible to obtain an image of heat waves as weak as those arising from the warmth of a person's hand.

The introduction of the gas-discharge tube provided photographers with a tool that was subsequently used merely as a convenient light source where no high speed was required. In America outfits incorporating these tubes are, unfortunately, commonly termed " strobe " lights.

The stroboscopic lamp proper,

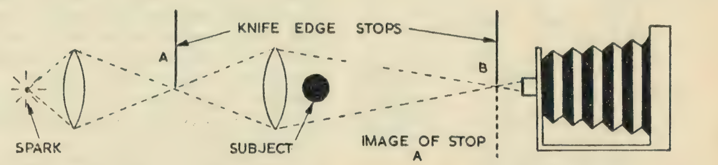


Fig. 1: The original Schlieren system

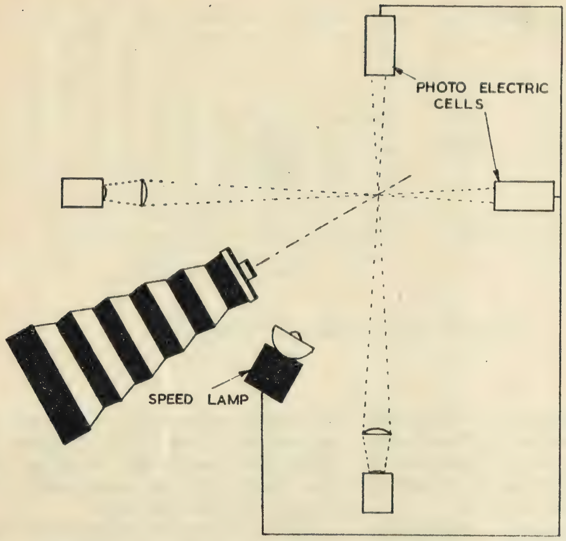


Fig. 3: *The use of photo-electric cells to trigger electronic flash*

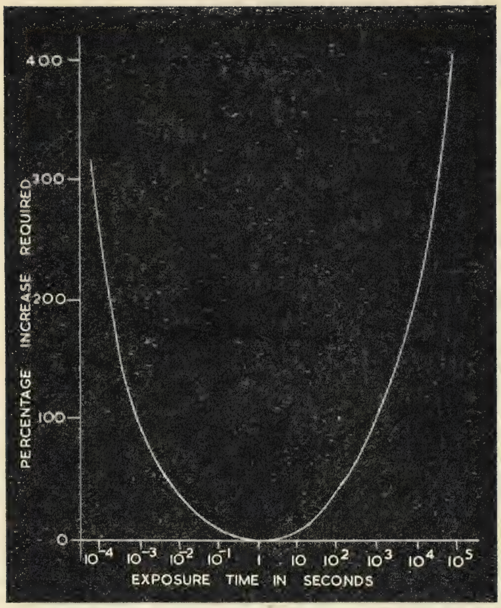


Fig. 2: *Graph showing a typical reciprocity failure curve*

although of some value in observing machinery in motion, is by no means as valuable as a high-speed cine camera. While the frequency of the strobe lamp can be adjusted to the speed of a cyclic movement the image one views is merely an integrated picture of the whole. Any slight variation in performance will be masked unless it recurs consistently, and in any case the random differences in relative position play havoc with the definition of the image.

The deflection of a car tyre upon striking an obstacle provides a good example of a field in which the stroboscopic method is of little value.

A high-speed cine film may, of course, be taken with the aid of a flashing lamp and this is a convenient way of making exposures. But a difficulty which manifests itself with this technique, is that the speed of the lamp must be synchronised with the continuously moving film in such a way that the individual frames are properly spaced so that a standard projector may be used. This naturally presents problems.

Film wastage

Another problem, which it is desirable to overcome in high-speed cine work, is the wastage of film while the motor is attaining full speed. This operation involves such a quantity of film that it is customary to employ a time-base and make use of this otherwise wasted emulsion. Leaders are not practicable since the splice could not "ride-the-gate" at high speed without sustaining damage.

An ordinary neon lamp can be incorporated in the field of view and from a knowledge of the frequency of the supply voltage it is a comparatively simple matter to calculate the film speed at any given point. This type of time-base is not sufficiently accurate for some types of work, however, and other more complex methods have been devised for special applications.

To find that a special high-speed cine camera is powered by a motor rated as high as 8 h.p. may seem startling at first sight, but from the foregoing it is clear that a high rate of acceleration is very desirable.

Multi-exposure

Not all studies are made by the cine technique. Sometimes relative movement can be seen more clearly if several exposures are made in quick succession on a single plate. This type of work is a favourite among nature photographers and several striking pictures have been made of birds coming to rest.

One novel technique in the ultra-high speed field is known as multiple-aperture focal-plane scanning. In this system a finely slotted screen is made to pass across the surface of the film for a distance equal to the space between two adjacent slots.

The amazing feature of this system is that even if the portions forming one frame add up to as little as five per cent of the whole picture area the image is still apparently strong in spite of its dilution. One camera constructed on these lines operates at the fantastic equivalent speed of 100,000,000 frames per second.

Although a large part of high-speed photographic investigation comes into the cine class some useful work can be accomplished with the aid of an ordinary electronic flash lamp, as used in still photography. A wide range of tubes is available today at prices from less than £3.

Generally, it is not practicable to make an ordinary camera shutter for operation at speeds much higher than 1/1,000 second and so electronic flash provides a convenient means of attaining a shorter exposure time.

High voltage

Attainable exposures vary considerably with the type of lamp and circuit employed. Much design work has been carried out in an effort to keep the inductance of condensers to a very low value but it cannot be eliminated, and since inductance in the circuit prolongs the discharge a small capacity is desirable for the shortest flashes. This necessitates higher voltages if the light output is to be maintained, and for the highest speeds the voltage used may be in the 10 to 20 kilovolt class.

The strain upon the condensers under discharge conditions is enormous. If the flash of a 100 joule (watt-second) outfit has a duration of

1/10,000 sec. then a million watts will be dissipated in the flash. This is a high figure, yet 100 joules is a comparatively low rating.

The design of the tube and the nature of its gas content are important factors. Traces of foreign gases are detrimental to the performance of a tube and one difficulty which arises in the manufacture of tubes is the freeing of the glass or quartz walls from adsorbed or occluded gases. This is a very real problem, as anyone who is familiar with vacuum equipment will know, since there is always some residue and this will tend to be freed by the operation of the lamp, especially if it is overrun.

For practical purposes the duration of a flash is not easily determined. The light output rises sharply during the initial stages of the flash, but the peak is followed by a "tail." Now this tail will provide sufficient light to make an impression upon the film in a case of over-exposure, and the duration is thus effectively increased. If, however, the film is under-exposed only the peak of the flash is utilised and the effective duration might then be very short.

Exposure accuracy

It is customary to specify the capabilities of tubes in terms of the duration above half-peak, but the value is likely to be three times greater if exposures are so adjusted that the output above only one-tenth peak makes an impression upon the negative. It is clear, therefore, that exposure determination must be fairly accurate for optimum performance.

Unfortunately there is no simple way of estimating exposure. The film speed figures quoted by manufacturers are practically useless for high-speed flash and, of course, an exposure meter of the normal type cannot be used. Furthermore, reciprocity failure is marked at the extremely short times involved (Fig. 2).

Bunsen and Roscoe's Reciprocity Law states, broadly, that for a given density, time × intensity is constant. For very short or very long times, however, the law does not hold for photographic emulsions and somewhat greater exposures are required than if the law did hold. Where exposures are in the 100 micro-second class, for instance, it may be necessary to increase the exposure from about five to eight times, although different makes of film behave in different ways in this respect.

Therefore, by far the most satisfactory method of determining exposure times is to establish a flash factor for the particular negative material used in conjunction with the flash outfit. This factor may take the usual form of lens aperture multiplied by the distance from the subject in feet, and having been found by trial and error for one set of conditions it will hold for a normal range of working distances.

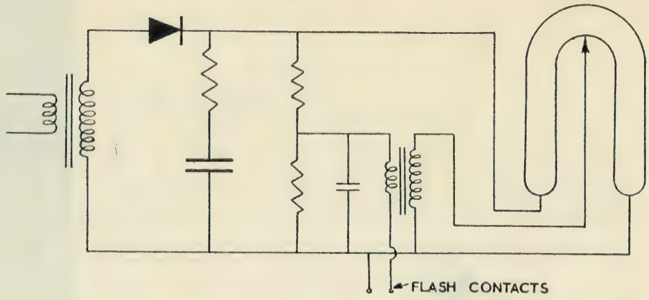


Fig. 4: Basic circuit for electronic flash

When high-speed still photography is applied to the study of machinery and other equipment it is often necessary to synchronise the flash with some particular phenomenon. This may be done in a variety of ways. Where sound is involved a simple microphone may provide the answer, and if a precise time lag is required this may easily be arranged by placing the microphone at a calculated distance from the equipment.

One novel system of triggering which has been used extensively for photographing insects in flight consists of two photo-electric cells set at right angles to each other. These are actuated by beams of light, the camera being focused upon the point at which they cross. By means of a suitable electronic circuit the flash is triggered only when an object cuts both beams of light simultaneously (Fig. 3).

Double-trip trigger

Where cyclic movements are to be studied it may be necessary to trigger the flash at a predetermined phase and for this requirement two trips may be used. The shutter may be operated at any time, providing that the time of one cycle is considerably shorter than the time for which the shutter is open. The two trips are arranged in series in such a way that when the shutter is released one, which is synchronised with the shutter, is set off, and the other, which is synchronised with the subject, will be set off at the predetermined phase.

A few types of tube have only two electrodes and with these it was necessary to fit the switch in the high-tension circuit—not a very desirable arrangement. Most tubes today, however, have a third electrode for triggering the flash and this enables a low-tension trip circuit to be used, the high-tension pulse being supplied by a step-up transformer. A car ignition coil may often be successfully employed for this purpose.

While the trip may be made through a relay the lag may be reduced considerably by the use of an electronic switch, and a thyratron is often employed for this purpose.

One interesting system, which is useful where several lamps have to be synchronised together as well as with the subject, employs triggering circuits actuated by photo-electric cells, the triggering light being synchronised with the subject. This method possesses the advantage of eliminating the numbers of trailing leads that would otherwise be necessary.

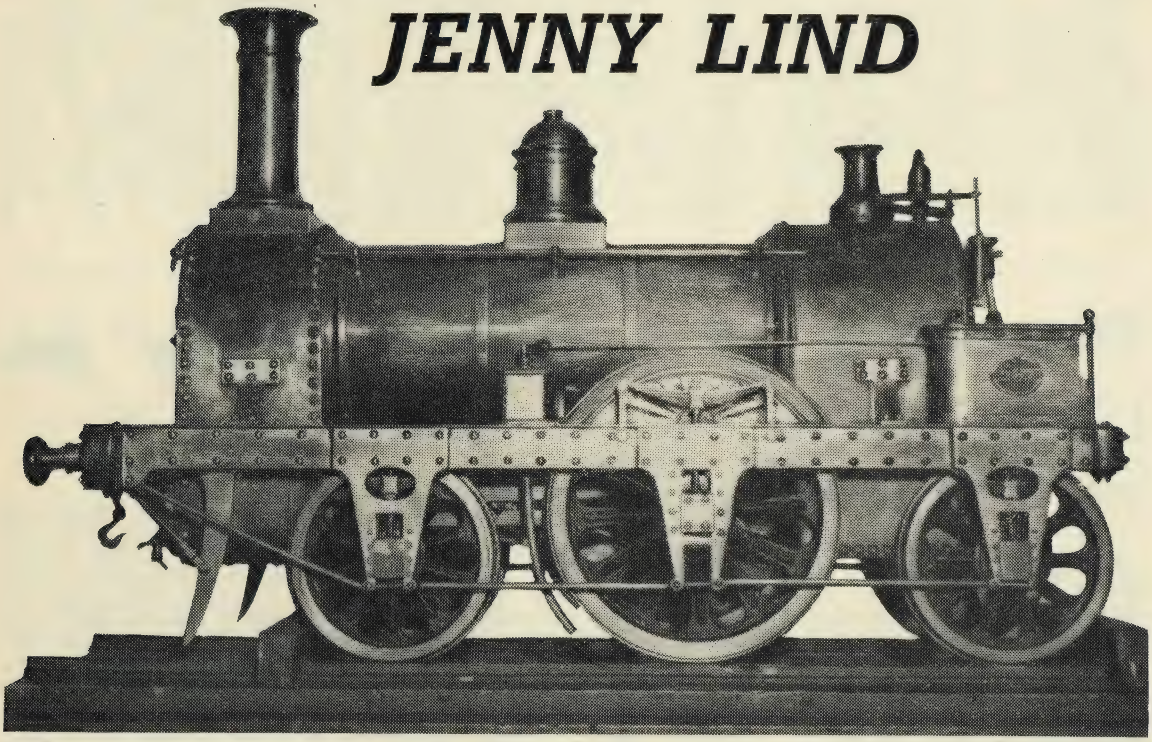
Can be dangerous

The triggering devices do, perhaps, produce an impression of great complexity but in fact the circuit for the flash outfit itself is basically simple (Fig. 4) and its construction is well within the ability of the average worker. There are many tubes available today which operate on comparatively low voltages and are capable of producing flashes in the 200 micro-second class. Furthermore, the development of electrolytic condensers specially for this application has cut the price of construction considerably.

To those who wish to make an attempt in this field one word of warning is necessary. The charge held by a high voltage, high capacity condenser can be lethal, and some precautions must be taken to ensure that they are fully discharged before handling. The circuit should incorporate a bleeder resistance to discharge the condensers when the outfit is switched off, for without this safety device the condensers may retain a dangerous charge for some considerable time. ▣

Grandfather died and left it to father—the engine that he had built in secret

JENNY LIND



By Winifred D. Brown

WHEN 66-year-old Mrs A. E. Sinclair of Leeds presented the model engine made by her grandfather to Kirkstall Abbey House Museum recently, she confessed that she knew little of its history—and still less about its "innards"!

"I wish now I'd taken more notice of what father told me about it," she says. "But I was 16 when grandfather died, and left it to father—and as I got the job of cleaning it, I didn't think much of it!"

Although model engineers may be shocked by this confession, Mrs Sinclair's youthful failure to appreciate "The Engine's" charms is understandable. For its steel chassis, tall brass chimney and brass-bound copper boiler obviously demanded—and received—an abundance of elbow-grease.

Engine No 287 is 2 ft 3 in. long, and 18 in. high from the base of its wheels to the rim of its brass chimney. Of $6\frac{7}{8}$ in. gauge, it has a normal 11-tube boiler, fitted with copper tubes approximately $\frac{3}{8}$ in. diameter. Its 8 in. solid-forged crank axle is in one piece, and its steel connecting rod and bronze big and small ends are correctly gib-cottered. Fitted with Stephenson link-motion valve gear, the weighbar shaft carries correct counter-balance weights, while slide-valves are mounted on top of its two cast-iron cylinders.

The cylinders have a bore of approximately $1\frac{1}{2}$ in. and a stroke of about $2\frac{1}{2}$ in., and are fed with oil by means of a cock fitted to its smoke-stack. (The cock-spigot is missing.) There is a smokebox regulator, and working sand-gear is fitted to the chassis on each side just in front of the centre driving wheels.

Its centre wheels have a diameter of $7\frac{1}{2}$ in. and the smaller front and rear pairs of 5 in. The centre driving wheels are cast whole, with the flange turned off, while its buffer beams and sprung buffer heads are of wood.

Mr R. Jeffrey, secretary of the Leeds and District Society of Model and Experimental Engineers, to whom I am indebted for these details, describes the engine as "a beautifully-made model."

Mrs Sinclair has always understood it to be a replica of the *Jenny Lind*, and while Mr Jeffrey cannot vouch for its being an accurate representation, he confirms that it is of the Jenny Lind type.

Its maker, Thomas Dixon, was the son of a Leeds wheelwright. Born about 1829, he was given no choice in the matter of a career, but—like many of his generation—was expected to follow in father's footsteps. Unable to fulfil his own ambitions of a railway future, he turned to the designing and making of this model as an outlet for his undiminished interest in engines.

Possessing far less leisure-time than a man in his position would have today, it took him seven years to complete the model. He often had to work on it by candlelight. One of the few things which Mrs Sinclair recalls about The Engine is hearing her great aunt (who lived with her grandparents) describe how she held candles for her brother-in-law when he worked on the model in his un-

JENNY LIND

Continued

heated attic workshop on winter nights.

Dixon kept the making of the model a close secret. This, Mrs Sinclair claims, explains his use of different types of metal. "He was terrified of anyone guessing what he was doing, so he got three or four different firms to make the parts he couldn't make himself," she said. "Afterwards, when his secret became known, the firms from which he had ordered the parts couldn't understand his being so mysterious about what he was doing."

Why was Dixon afraid to let it be known that he was making the model? Here again I can only record another of Mrs Sinclair's fragmentary recollections. She claims that The Engine embodies an invention of her grandfather's which was seen, copied, and introduced subsequently into a "proper" locomotive by a "real" locomotive designer. As the exact date of the model's construction (about 1870-75) is now a matter of approximation only, in the absence of any records this cannot be confirmed. Did it occur at an early stage in its making, and so explain Dixon's "secrecy"?

In later years, The Engine was exhibited in London on at least one occasion, and was run. On its return, its fire-scarred ashpan and grate were removed, to be replaced—or so Dixon intended—by new ones. They never were replaced, and are still missing. Nor did Dixon ever complete the tender he had always planned to make. ▣

The story of a tricky repair job

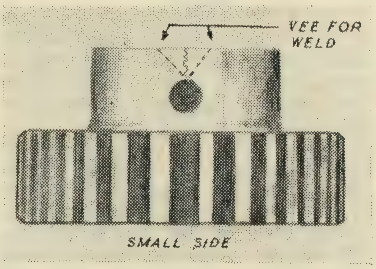
By *Miles Obscurus*

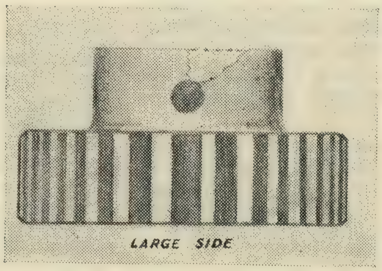
I THINK it was your contributor Geometer who in one of his useful articles mentioned the method of fixing pulleys, gearwheels and so forth to their shafts by means of a tapered pin driven lightly into a tapered hole.

He did not go into what happens when some operator of the type referred to by that eminent Latin scholar Professor Jimmy Edwards as *clottus ineptus* tries to get the pin out by belting it on the *larger* end with a hammer.

I now know what happens. The sample given to me to mend looked like the accompanying illustrations, the crack going through to the hole.

The shaft may well have been part of a fairly large machine: anyhow I had not got it, and the problem appeared to be to retain the alignment of the tapered hole, and to leave enough of the original bore clear of welding or brazing material to ensure that it could be securely mounted on a mandrel so as to machine it to run true again on its shaft.





I could easily have cut down the crack on the least damaged side and run in Sifbronze, but I didn't much like the idea of replacing the missing piece on the other side with Sifbronze, although I am sure someone more in practice than I could have done it.

I therefore veed out the cracked side to just short of the hole, gave the whole wheel a good pre-heat, and then started to build a "bridge" across the larger hole with cast-iron welding rod, working a little at a time from each side until I had the gap bridged with a minimum of welding metal run into the tapered hole. It was then easy to build up metal to replace the piece broken out and to fill up the vee on the other side.

The whole wheel was then raised to a dull red and put under asbestos to cool off slowly.

A trial with an old file showed the weld metal to be fairly machinable, so a m.s. mandrel was turned a tightish push-fit in the bore, the gear wheel pushed on it, and the end and exterior machined to size.

The next job was to true the bore, but another trial showed a hard spot where some weld metal had adhered too firmly to be chipped off, but had not been affected by the annealing. This is the snag in simple cast-iron welding—you can easily get a hard spot. I saw no point in knocking the edge off boring tools or expanding reamers which I want to use on genuine model-making jobs, and luckily I found a small rough grinding wheel which, mounted in a Handy Utility, removed enough metal to get down to the annealed metal. Replacing it on the mandrel, I bored it out to within a few thou of finished size, and finished it with an expanding reamer put in from the gearwheel end to correct any possible error in alignment.

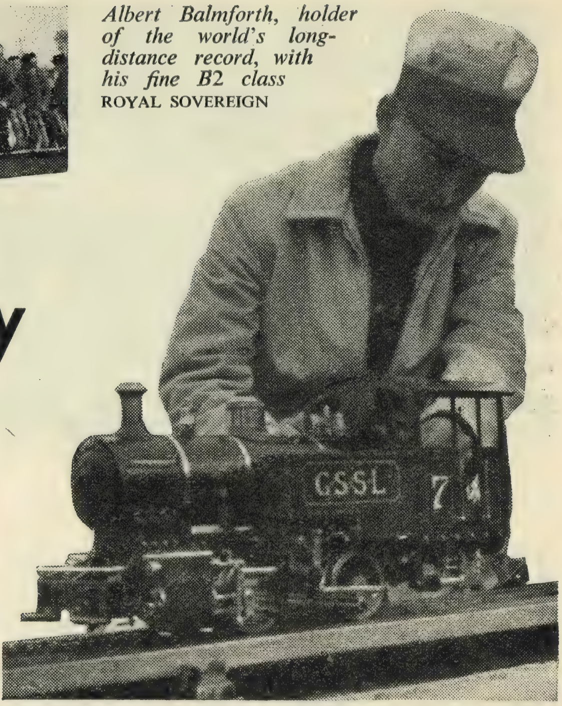
There remained the taper hole for the pin. The small end was intact, and I cleaned out most of the waste weld metal from the other end with a file, taking care not to touch the original bore. I finished it to size with a borrowed taper reamer.

As the welding did not fill up the cracks in the taper hole solidly, the job could not be called perfect as a weld; but it should enable the machine to be used until *clottus ineptus* reappears with his heavy hammer.

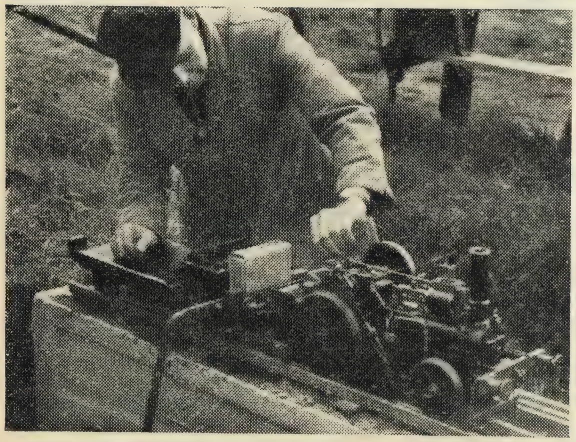
Which is where we came in. ▣

Albert Balmforth, holder of the world's long-distance record, with his fine B2 class ROYAL SOVEREIGN

West Riding Rally



Above: With the Warrington society came their guest Major Douglas T. Peck, of the USAF, with genuine head-gear and a 3½ in. gauge 0-4-0 switcher. This is basically LBSC's JULIET *with Baker valve gear and Baldwin look*

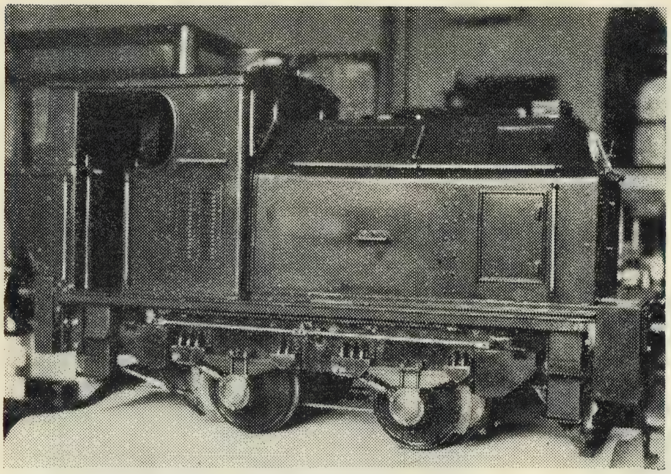


Above: A regular visitor to the Blackgates "do" is A. E. Tyler, of the Harrow and Wembley club. Here he is with his Aveling and Porter "traction engine" type industrial locomotive which he built to ¾ in. scale

NORTHERNER records some of the events, and adds the commentary on this Yorkshire get-together

Gerald Clarke, a junior member of Urmston MES, drives his 0-4-0 tank DOODLEBUG *built by Jim Moss of Leigh*

Alan Tyler puts a delicate finger to the controls and is watched eagerly by a model engineer of the future



J. J. Constable's 5 in. gauge Sentinel steam locomotive

News of a W

CHWARAU-TEG takes a look three-day C

It is always difficult to present a completely new set of models when exhibitions are held at regular intervals but the selectors of the recent three-day exhibition staged by the Whitchurch and District MES at Roath Church House, Cardiff will certainly have food for thought when deciding on the models which are to grace the South Wales and Monmouthshire Federation stand at the ME Exhibition in August.

Over a century was covered by the models on view. These ranged from a near relation of Stephenson's *Rocket* (a very nice *Rainhill* by J. Hughes) to a set of rockets by L. Davies which included a model of Baumer's infernal machine which propelled the buzz-bombs over London during Hitler's brief reign.

Some 20 locomotives were on view. Times of long ago were recalled by B. C. Wood with his 5 in. gauge *Titfield Thunderbolt* chassis and tender. Full working Gab gear is fitted. The engine has passed air tests satisfactorily. A more modern locomotive was a $1\frac{1}{16}$ in. scale model of a coal-fired 100 h.p. Sentinel steam locomotive by J. J. Constable. This was practically finished, having successfully completed steam trials and received its first coat of paint. If present plans mature it will be on exhibition at the forthcoming ME Exhibition. An unusual model was a 5 in. gauge chassis of *Anne of Holland* by J. Padfield which gave every indication of what will be a very powerful engine.

One of the largest exhibits in the locomotive power department was D. Williams's 5 in. gauge Castle. Boiler and chassis were in an advanced state of completion. This locomotive should certainly lap up the gradients on the new track under construction by the St Mellons brotherhood.

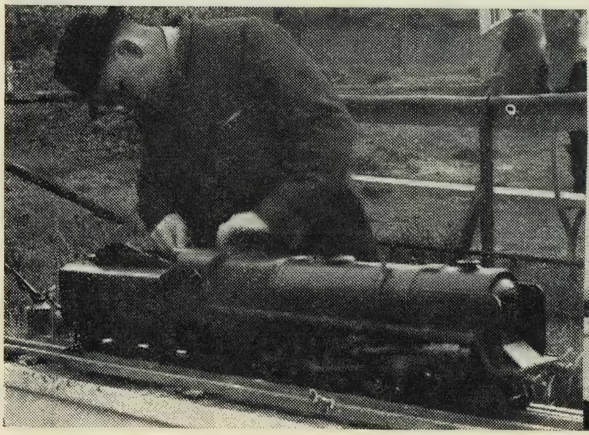
In another part of the show R. Page's Allchin chuffed round the exhibition floor. It was evident that with 100 lb. on the clock plenty of power was available to haul the visitors, many of whom had never seen a prototype in operation.

One of the popular stands displayed old-time earth-moving equipment by L. Heath. Visitors were intrigued by the models of the Dobbin carts used in the construction of Cardiff's world famous City Hall, the contractors' tip wagons headed by a re-modelled *Tich*, the beautifully carved horses and a 1/10 scale model of a Smith's steam crane fitted with navy attachment.

In the stationary engine department, A. Bready's hauling engine complete with house was an ever popular exhibit. His horizontal engine of 1860 and J. J. Smith's compound marine engine, although previously seen, were

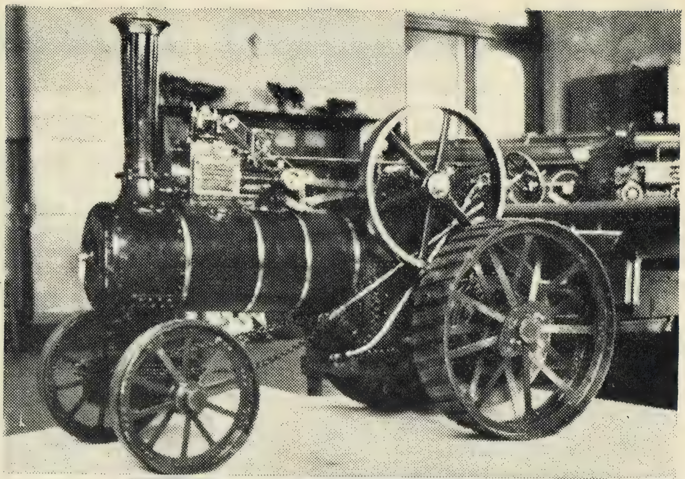
West Riding Rally . . .

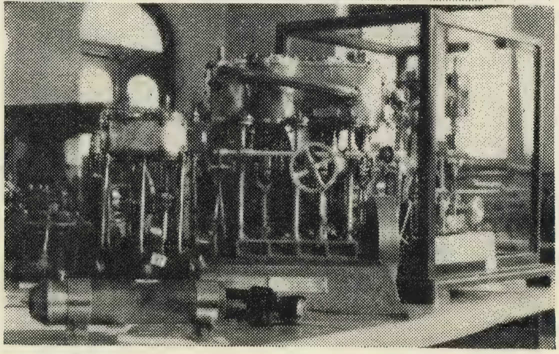
One of LBSC's most popular designs has been BRITANNIA. *Roy Bairstow of Wakefield (left) has used the "words and music" in building* ARIEL *to his own personal taste. Right : Engineman Douglas T. Peck sets a merry pace*



elsh exhibition

at the fine selection of work at the ardiff exhibition





Above: One of the several traction engines that were shown at Cardiff

Right: The compound marine engine by Mr J. J. Smith is prominent on the stationary engine stand. In the foreground is the buzz-bomb set which Mr L. Davies built

nevertheless as full of interest as ever.

On the boat stands graceful backgrounds were provided by the 6-metre yachts of F. Angwin, J. Hall and A. Crocker. In the tank T. Whitaker's tug *David* peacefully toured the perimeter. The tranquil scene was only broken when the uninitiated visitors asked this lover of steam how long the batteries lasted ! The oscillating engine's quiet running and barely visible exhaust passed unnoticed except by the observant spectator.

Things in motion are not only attractive to visitors but also instructive. A stand of this nature is almost a must for any exhibition. Some dozen animated models kept the stewards busy with the oilcans and answering the whys and wherefores of the many spectators who thronged the stand. J. Wheton had his *Iris* ticking over in turn with H. Reyland's *Doris.* In addition to the locomotives a Stuart mill engine by R. Garner, a Theseus of Westbury design, a vertical Stuart and several others all added to the interest.

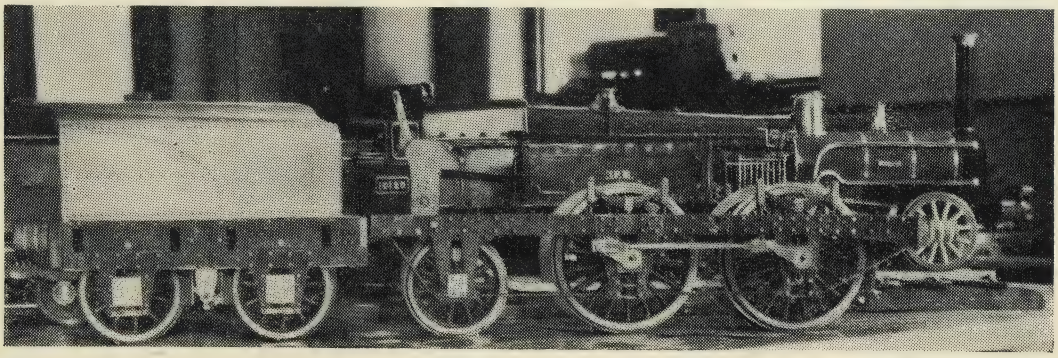
In the smaller gauges H. Fletcher's 4 mm. working branch terminal was a source of enjoyment not only to fathers but also to their sons. D. Budding's American standard locomotive in 7 mm. and his *Duchess of Dufferyn* would gladly have been taken home by some of the younger visitors.

The club premises must certainly have looked bare to any visitors for almost the entire workshop was transported to the exhibition. A grand idea this, for though a lot of work was involved, visitors could see some of the machines in use. The club ML7 lathe together with small drill stand, grinder, vice and the necessary benches were not only useful for executing running repairs but members were to be seen actually working on some of the parts for their latest projects.

In addition to the club equipment, D. Williams must have badly denuded his own premises for he had on view his drilling machine, hand shaper, hacksaw machine, bending rolls and a massive locomotive testing stand. This, when completed, will accommodate not only several gauges but also almost any wheel arrangements.

In a brief review such as this it is impossible to cover the nearly 100 models on view which were enjoyed by the visitors. I was impressed by the willingness of the stewards to show or demonstrate any model to interested visitors. It was noticeable that as soon as a particular item was being demonstrated a number of people gathered round.

A most noticeable feature of the exhibition was the complete absence of "Don't Touch" notices. Watchful eyes were kept on both small and large fingers but no unwarranted liberties were taken. ▣



The TITFIELD THUNDERBOLT *chassis, the* RAINHILL *and the Sentinel steam locomotive are exhibited on this stand*

Information bureau

Notes on a Pansy in $3\frac{1}{2}$ in. gauge; hints on fitting the Baker valve gear—"I am here to help," declares LBSC

It happened exactly as anticipated! "It never rains but it pours" is a true old saying; and no sooner do some notes on building *Pansy* to half-size appear in these columns, than in come some more requests for information on a $3\frac{1}{2}$ in. gauge version. Well, I'm here to help wherever I can, so let's see what can be done about it.

First of all, there is a very simple way of scaling my locomotives up and down without the need for being a juggler arithmetician. If you want to reduce the size of a 5 in. job to $3\frac{1}{2}$ in., simply remember that there are ten $\frac{1}{2}$ in. in 5 in. and seven of them in $3\frac{1}{2}$ in., so all there is to do is to reduce the 5 in. measurements in the proportion of 10 : 7. To get 5 in. dimensions from $3\frac{1}{2}$ in. ditto, just reverse the process. To reduce $3\frac{1}{2}$ in. dimensions to $2\frac{1}{2}$ in. the proportion is 7 : 5. Quite simple isn't it? If you draw a scale on a strip of cardboard you can read the required dimensions at a glance.

Frames for $3\frac{1}{2}$ in.

Anyway, to save as much trouble as possible to the $3\frac{1}{2}$ in. gauge querists, I have drawn out the frames for a $3\frac{1}{2}$ in. gauge *Pansy* and put all the dimensions in. Cut the frames from $\frac{1}{8}$ in. mild steel, bright or blue, in the same way as described for the 5 in. job. I haven't put the screwholes in, but these can easily be located from the drawing of the 5 in. frames.

The buffer beams are made from 1 in. × $\frac{1}{8}$ in. angle, to the dimensions shown. The frames may be attached to them by pieces of $\frac{3}{4}$ in. × $\frac{1}{8}$ in. angle riveted to the sides of the slots, as shown in the 5 in. drawing, or just brazed into the slots. The hornblocks specified for my other $3\frac{1}{2}$ in. gauge locomotives can be used—and the same applies to the axleboxes and springing. The motion plate forms one frame stay, and another is fitted just clear of the crank axle as in the larger engine.

Stock-size wheels of $3\frac{1}{2}$ in. dia. can be used, those with small pear-shaped bosses being preferable, as the throw of the coupling-rods is less than that of the cranks. On my 0-6-2 tank engine, which has similar wheels and cylinders, the throw of the coupling-rods is $\frac{9}{16}$ in.; and she works perfectly. The position of the balance weights doesn't matter.

A drawing of the crank axle, fully dimensioned, is shown. This is the same as fitted to my LBSCR engine *Grosvenor*, so it has been tried, tested and decidedly not found wanting. A few evenings ago she made a nonstop run of just over $2\frac{1}{2}$ miles. The construction can be carried out as described for the 5 in. job, using press-fit joints, or it can be brazed, as I specified for the $2\frac{1}{2}$ in. gauge version. In case builders prefer the latter method, I have included the exact setting of the four eccentrics, which can be turned from the solid, using a piece of mild steel $1\frac{3}{4}$ in. dia. Don't forget to leave a $\frac{7}{16}$ in. × $\frac{1}{4}$ in. spigot at each end of the cluster, which is pressed into the adjacent crank web as mentioned in the $2\frac{1}{2}$ in. notes, the crankpins being set as shown in the dotted circles.

No need for cramp

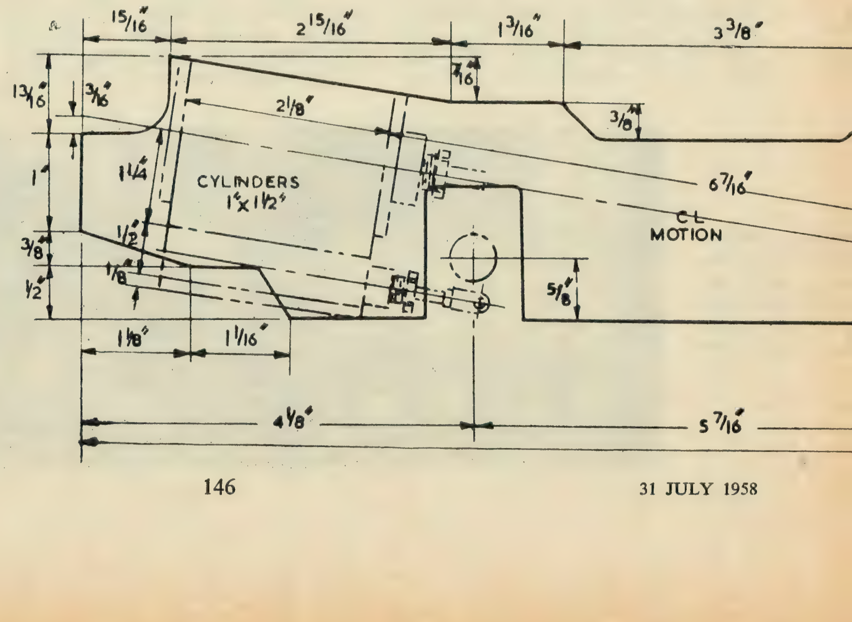
As a matter of fact it isn't such a terribly difficult job to turn the whole bag of tricks from the solid, using a piece of mild steel $2\frac{1}{4}$ in. dia. and $4\frac{1}{2}$ in. long, an offcut of shafting being just the identical. In the old foot-slogging days such a job would have resulted in an attack of cramp in the thighs in the middle of the night (I've had some) but with a power-driven machine such as a Myford ML7, or a "Supersonic"—I never call mine anything else!—and high-speed tools, it is merely a matter of patience, and sweeping up a barrow-load of swarf afterwards.

If the crank axle is made with press-fitted joints, turn the four eccentric tumblers separately to $1\frac{1}{8}$ in. dia. $\frac{3}{16}$ in. thick, and the $\frac{1}{2}$ in. axle holes $\frac{1}{4}$ in. off centre. Fit 6 BA steel set-screws, pointed and hardened.

Cylinders

No special castings are needed for the cylinders. They can be machined up from the castings supplied for *Molly* or *Petrolea*, both of which were arranged to have the steam chests underneath. *Petrolea* has an inclined portface, but it is easy enough to machine it off parallel with the cylinder bores. I have shown the bore diameter as 1 in. in the drawing, which allows of ample clearance at each side of the castings, and plenty of room to drill the exhaust-way between, but there is no objection to boring $\frac{1}{16}$ in. or so larger and bringing them to full "scale" size. The boiler will supply all the steam needed without exerting itself; it wouldn't be a Swindon boiler if it didn't.

The cylinders are machined up as described for other inside-cylinders described in these notes, the *Molly* dimensions being followed except for the difference in the centres of the valve spindles. *Molly's* were set at $1\frac{1}{8}$ in. centres, but *Pansy's* are at the same centres as the cylinder bores, namely $1\frac{1}{2}$ in. This has necessitated the ports being slightly shorter, to

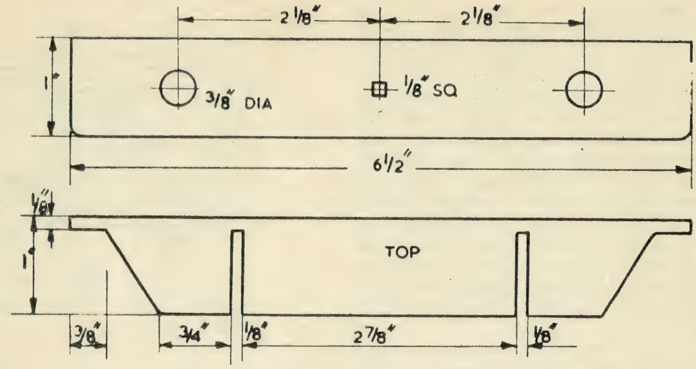


keep the slide valves clear of the steam chest walls. To prevent any confusion I have shown a drawing of the portface with the location and dimensions marked on it.

When marking out the frames, scribe the centre line of motion on both very clearly; this runs from the centre of the driving axle to a point $\frac{3}{16}$ in. above the front end of the frame at the place where the buffer beam is fitted. The cylinders are erected with the centres of bores on this line, and the back of the casting set at $6\frac{7}{16}$ in. from the centre of the driving axle. In the cross-section through the exhaust ports I have shown the sides of the cylinder casting extended to come level with the top of the frame, as this is more convenient for bolting.

If *Molly* castings are used, it will be found that the sides don't extend right to the top (this was to enable stock castings for top-valve cylinders to be used upside down, to save fresh pattern-making) but it makes no difference to the cylinder position. All that is needed is to set the upper row of fixing-screws a little lower down. Be careful to drill and tap the holes for them in the cylinder block without piercing the bores.

The above should give $3\frac{1}{2}$ in. gauge *Pansy* builders a jolly good start on the job, and all being well I'll provide a few more details as the serial on the 5 in. engine proceeds.



BUFFER BEAM

Baker valve gear

When old Abner Baker first conceived the idea of the valve gear that bears his name, he aimed at something that could be made very simply, with easily renewable parts, and, above all, could be used on any locomotive without alteration. The final form of the gear was such that it could be fitted to any type of engine, merely hanging up the self-contained collection of blobs and gadgets in the most convenient place, and connecting it up to the return crank (called an eccentric crank in USA and Canada) and the combination lever.

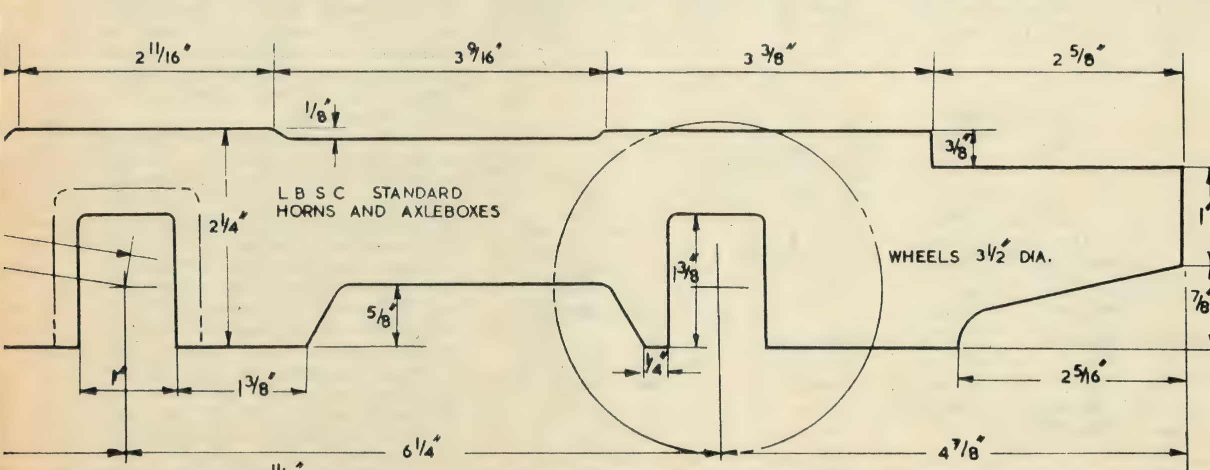
Exactly the same applies to the gear for little locomotives. When I first became acquainted with the details of the Baker gear, I was so impressed by its simplicity and adaptability that I built a locomotive in $2\frac{1}{2}$ in. gauge which combined what I thought to be the better features of both British and American design, and included Baker valve gear. This was *Fayette*, which I described in detail in MODEL ENGINEER, and goodness-knows-how-many replicas were built. Full-size blueprints were issued for it by Percival Marshall.

I fitted the gear to several engines and got out the dimensions for $3\frac{1}{2}$ in. and 5 in. gauge engines. The dimensions for $2\frac{1}{2}$ in. and $3\frac{1}{2}$ in. are shown in the *Live Steam Book*; the dimensions for 5 in. are obtained by doubling the $2\frac{1}{2}$ in. ditto. As the Baker gear is standard for any engine, there is not the slightest necessity for anyone who wants to fit the gear to a new engine, or convert an existing engine, to make any drawings at all. Make up the two sets of gear to the dimensions I have given, using either the bracket or girder type frame according to the type of locomotive, and erect them according to the instructions below.

Attaching to Tich

In the case of *Tich*, the bracket type of gear frame is most suitable, as it can be attached to the guide-bar support which carries the bearing for the trunnion of the Walschaerts expansion link in the original design. Erect the frame at such a height that the lower end of the gear connecting-rod (the sickle-shaped piece) is about $\frac{1}{16}$ in. below the centre line of motion. By the way, as the cylinders of *Tich* are only as large as those of a normal $2\frac{1}{2}$ in. gauge engine, the dimensions of the $2\frac{1}{2}$ in. size of Baker gear should be used when making up the sets.

The swing of the return crank of the Baker gear should be three times the amount of movement required for the slide valve in full gear. On my own *Tich* (which has outside link motion,



FRAME

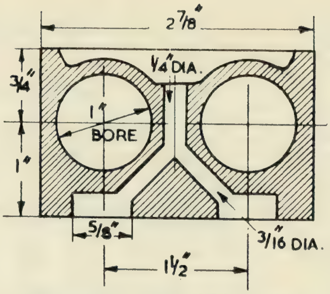
as mentioned at the early part of the year) the valve travel in full gear is barely $\frac{1}{4}$ in. so that the return crankpin is set at $\frac{3}{8}$ in. from the main crankpin on the centre line of motion. As the main pin is $\frac{9}{16}$ in. from the centre of the axle, the stroke of the cylinders being $1\frac{1}{8}$ in., the distance from the centre of the main pin to the centre of the return crankpin works out at 21/32 in., as near as makes no odds, and the return crank should be made that distance between centres. Set it to lead the main crank, with the pin as near $\frac{3}{8}$ in. off centre as you can measure with a rule.

To set it exactly, and at the same time get the exact length of the eccentric-rod, put the gear connecting-rod in such a position that when the reverse yoke is swung back and forth, the lower end of the bell crank doesn't move. Temporarily fix the gear con-rod in that position, taking the greatest care to avoid shifting it, then put the main crank on front dead centre. With a pair of dividers, take the distance from the centre of the hole in the gear con-rod to the centre of the return crankpin. Turn the main crank to back dead centre and apply the dividers again, to the same places.

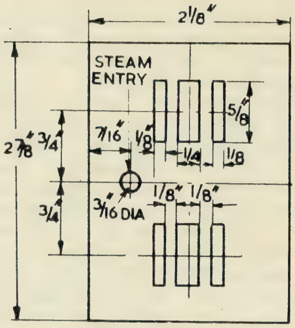
Correct setting

If they tally first time, it will be a miracle. If they don't, adjust the return crank so that the pin moves half the difference, and repeat operations. When the distance between the points tallies on both dead centres, the return crank is correctly set, and the distance between the divider points is the exact length of the eccentric-rod between centres of holes. Pin the return crank in position and make the eccentric-rod to the divider setting. It can then be erected.

All that remains is to get the length of the valve rod connecting the bottom of the bell crank to the lower hole at the top of the combination lever. This is just as simple. Put the reverse



SECTION OF CYLINDER THRO EXHAUST PORTS



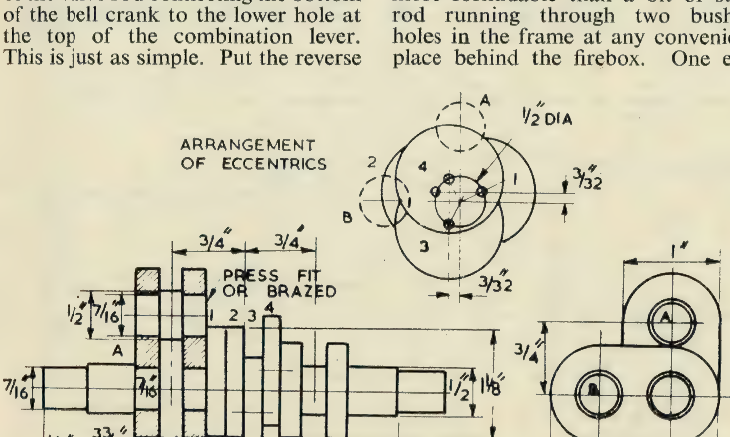
PORT FACE

yoke in such a position that, when the wheels are turned by hand, the bottom of the bell crank doesn't move. Secure it temporarily from shifting; then, with the piston at half-stroke and the combination lever at right angles to the centre line of motion, take the distance between centres of the lower hole at the top of the combination lever, and the hole at the bottom of the bell crank. Make the valve rod to that measurement, and fit it.

To check the valve setting, put the main crank on front dead centre; and with the reverse yoke as far forward as it will go, adjust the valve on the spindle until the front port just cracks at the edge of the valve. Then go around to back dead centre. The back port should crack likewise. If it doesn't, the valve is a shade too long, and a little should be filed off both ends, to keep the exhaust cavity central. When both ports crack on the corresponding dead centres, with reverse yoke forward or backward, the setting is correct.

The reverse yokes are operated by a reversing shaft which is nothing more formidable than a bit of steel rod running through two bushed holes in the frame at any convenient place behind the firebox. One end carries the reversing lever, which is connected to the reverse yoke on the same side by a 3/32 in. rod with a fork at each end. The other end of the shaft is furnished with a vertical arm carrying a similar reach-rod. The distance between the shaft, and the reach-rod attachment on both lever and arm, must be the same, and the reach-rods exactly the same length. The lever can be fitted with a notched quadrant, trigger, and latch as described for the Walschaerts gear in the *Tich* instructions.

ARRANGEMENT OF ECCENTRICS



CRANK AXLE

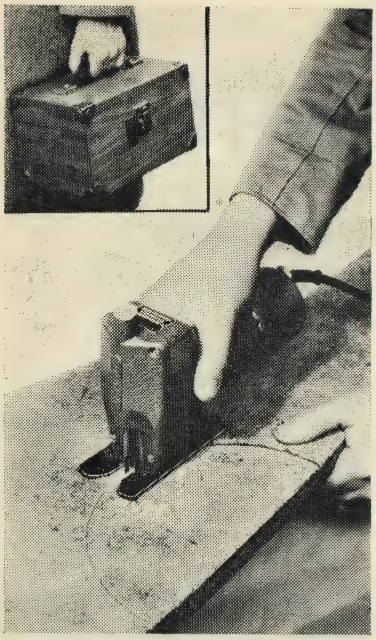
Driver Irvin's Atlantic

As there seems to be a lot of misunderstanding floating around about the late Driver Bill Irvin's $3\frac{1}{2}$ in. gauge Atlantic locomotive, maybe I'd better clear it up. It was definitely *not* one of the earliest passenger-haulers, nor did it date from 1904. Here is its history.

Soon after I made his acquaintance, Bill told me that he felt rather uneasy about always driving other folks' engines on the SMEE track, and would like to have one of his own. He couldn't build one himself, as at the time he was living in a block of flats, Peabody's Buildings, in Farringdon Road, London and had no workshop. He said that if he could get a cheap used or unfinished engine, would I do the needful and make it pull a living load?

I had a great liking for honest rough-and-ready Bill, and readily agreed. In due course he brought along the assortment of junk that was supposed to be a $3\frac{1}{2}$ in. gauge GNR Atlantic. I forget where he got it from. The boiler was supposed to be fired with a Primus oil burner, and had field tubes dangling from the crown sheet of the firebox. Some of the boiler plates were castings. The valve gear was hopeless, and there was no means of feeding the boiler, no lubrication, and a lot of other defections. The engine had apparently never turned its own wheels.

● *Continued on page 157*



Around the trade

More discoveries to make the job easier

A PORTABLE ELECTRIC SAW

THE Lesto electric saw shown in the photograph is described by the makers as a jig-saw; but to distinguish it from the type of machine generally understood by this title, we prefer to call it a " sabre " saw, as the blade is rigid, and held only at the driving end. It is, therefore, much more adaptable than a jig-saw, as it has unlimited reach and can be used in blind holes without detaching the blade.

The saw reciprocates at a speed of 2,900 strokes per minute, and will cut wood up to 2 in. thick, or mild steel up to $\frac{3}{16}$ in. thick; other materials including plastics and fibreglass can be dealt with equally efficiently, using the appropriate blades in each case. Tests made in the ME workshops, cutting $\frac{1}{2}$ in. laminated fabric-base bakelite, gave a very satisfactory result, with high rate of cutting, and a clean finish. The saw can be operated with one hand, leaving the other free to manipulate the material.

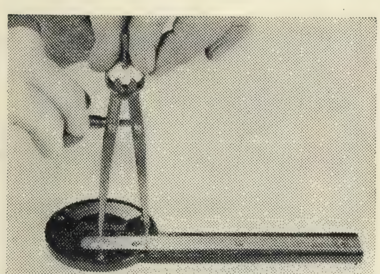
Listed as type GEB14, the Lesto saw weighs only 5 lb. and is available in voltages from 50 to 250, a.c. or d.c., with 200 watts consumption. It is marketed in Britain by Trend Industrial Equipment, Ltd., 5 The Ridgeway, Stanmore, Middlesex.

A PRECISION DIVIDER SETTING DEVICE

MANY occasions arise in model engineering and toolmaking where it is necessary to set out radial and other measurements with dividers to a high degree of accuracy. The usual method of setting the divider points to the engraved scale on a rule is far from satisfactory in this respect, apart from being inapplicable to odd measurements for which no scale is available.

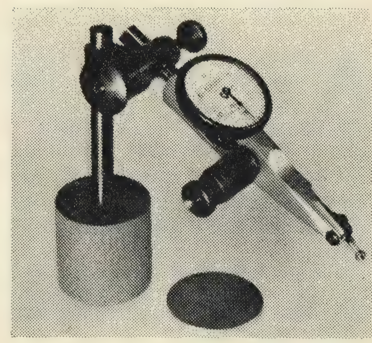
A very ingenious device, known as the Leytool micro divider setter, has recently been introduced, which makes it possible to set divider points to a limit of 1/1,000 in. for any measurement between $\frac{1}{4}$ in. and 6 in. It incorporates a fixed linear scale having indentations exactly $\frac{1}{4}$ in. apart, in conjunction with a circular rotating scale, equipped with a vernier reading in 1/1,000 in., and having a projecting pin with a centre indentation in which one divider point may be located.

With the other divider point in the first indentation of the linear scale, and the circular scale reading zero, the distance apart of the points is exactly $\frac{1}{4}$ in. Any increment between this and $\frac{1}{2}$ in. displaces the projecting pin and rotates the circular scale to



an extent indicated on the vernier; further distances are obtained by shifting the divider point to other positions on the fixed scale, up to the maximum of 6 in. The instrument is finished in black crackle enamel, and supplied in a leatherette case. It is produced by the Leytonstone Jig and Tool Co. Ltd., Leytool Works, High Road, Leyton, London, E10 and is obtainable through dealers in high-class tools.

A MAGNETIC DIAL INDICATOR HOLDER



MOST of our readers are already familiar with the Verdict dial test indicator, which is one of the handiest and most compact instruments of its kind, applicable to either inside or outside surfaces and capable of use in situations inaccessible to a standard size d.t.i. The makers of this instrument have now further increased its scope by providing a simple magnetic holder, with an extension clamp capable of holding it at any angle.

The permanent magnet employed is of the " pot " type, having a central pole and an outer annular pole, and is of high-efficiency alloy steel, which produces a very powerful grip on any iron or steel surface. When not in use, a keeper in the form of a steel disc is used to protect the pole surfaces and avoid risk of demagnetisation.

The magnetic holder, complete with the extension clamp, is sold separately from the Verdict indicator, and can also be usefully adapted to mount a scriber or other instrument on the lathe or other machine tool. It is manufactured by Messrs. A. Capp and Son Ltd, Verdict Gauge Works, Thames Road, Crayford, Kent.

Detachable hammer heads

A reminder that the Thor hammer, with its detachable heads, is a very useful and versatile tool in the home workshop.

IN THE ME WORKSHOP

COLLET CHUCKS

These accessories are so well produced commercially that the amateur tends to fight shy of making them

By EXACTUS

AMONG the many interesting articles on lathes and their equipment, seldom do we find the subject of collet chucks. I do not know why this should be. Perhaps the high standard of the commercial collet chucks leads the average man to think that they are above his capabilities.

This is not really true, and my object here is to help readers who would like to try their hand at making these very useful accessories.

I can assure readers who have not worked with collets that they have a pleasant experience in store. Collets must be used to be appreciated. Their great value is in the making of small parts, particularly in quantities, quickly and accurately. The work can be held with good rigidity because the amount of overhang from the nose spindle is reduced to a minimum. There is also no fear of marking the work, as nearly always happens when you are doing the same thing in a three-jaw self-centring chuck.

The only complaint I have ever heard about collets is that their capacity range is limited to a few thou above or below the specified size. In other words, a $\frac{3}{8}$ in. collet will only take a piece of material that size, and cannot be expanded to take a piece of $\frac{7}{16}$ in., or contracted to take $\frac{5}{16}$ in. This means that a number of collets is required for a set to take material from $\frac{1}{8}$ in. to $\frac{1}{2}$ in. The increments in which they increase can be 1/64 in., 1/32 in. or $\frac{1}{16}$ in.

I do not consider this a serious argument against collets in preference to a three-jaw chuck; it is more of a prejudice.

Young readers, and those in the early stages of their turning experience, may wonder exactly what a split collet is, and how it is used in the lathe. There are several different types of design and methods of application which I will deal with later; meanwhile a typical pattern of design is illustrated in Fig. 1. It takes the form of a parallel cylinder with a sharp taper on the outside at the front end. At the other end is a fine thread for the draw-in bar.

The front of the collet is bored to the size required and then, after a suitable distance, is relieved to give clearance and to make it light and flexible. To allow the collet to contract when pulled into the mating cone or taper, it is slotted longitudinally for approximately two thirds of its length. The number of slots can vary. Some collets have three, others four all equally spaced; and the Myford collet has six. The usual number is three. At the threaded end, a shallow keyway is cut for engaging in a stop pin. The way in which this type of collet can be fitted to a lathe is shown in Fig. 2. An adaptor or sleeve is fitted to the nose of the lathe spindle by inserting it in the Morse taper. There are other methods, and we will come to them later. The adaptor is bored to suit the collet with the front end bored at the same angle of taper.

Getting the angle of taper identical is very important, and when making these accessories it is advisable not to alter the topslide once it is set for turning taper. At the inner end of the adaptor can be seen the stop pin engaging in the keyway. An easy fit is quite sufficient, because it does no driving; its only function is to stop the collet from turning while tightening the drawbar.

To give the front of the adaptor strength it has been thickened. I think the method of operation is fairly obvious and easy to follow from the drawing. The work is placed in the collet and the drawbar screwed up. This draws the collet into the adaptor, the taper causing it to close in on the work and grip it firmly.

The main thing to consider when designing a set of collets is the angle or taper of the cone. The dimension must be kept within reasonable limits, for several reasons. A large taper means a greater diameter of the front of the collet if sufficient bearing area is to be had. Again, the power required to close a collet with a large taper would be excessive, and in turn would put undue wear and tear on the thread.

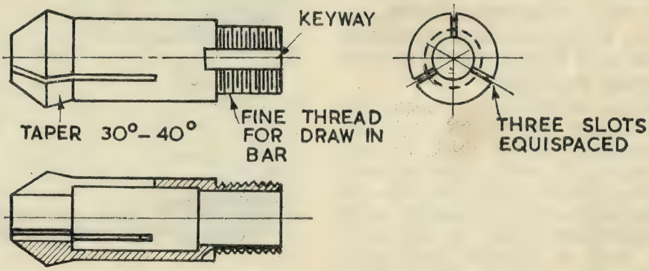


Fig. 1: An example of a split collet for drawbar operation

Going to the other end of the scale, so to speak, a collet with only a slight taper would not have difficulty in gripping the work—only when trying to release it. This is the main drawback of making collets to fit directly into the Morse taper of the lathe spindle. When this method is used, the drawbar has to receive a

Here is a collet chuck without a drawbar fitted to a Portass lathe

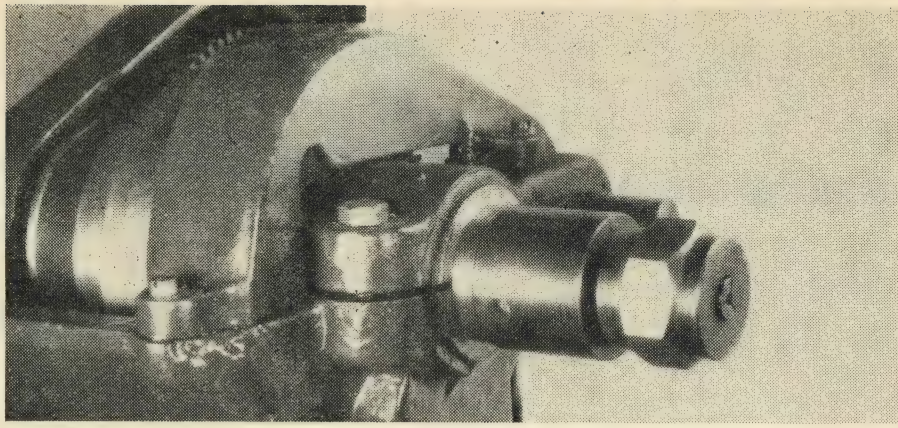
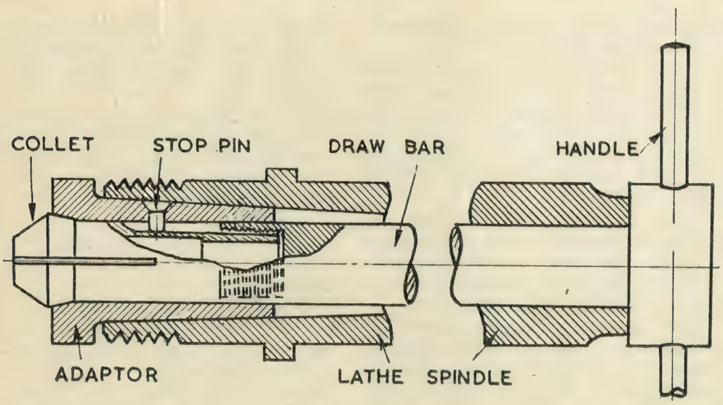


Fig. 2: Adaptor and drawbar for pull-in collets



light tap to free the collet from the taper to release the work.

The Myford collets which fit the No 2 Morse taper of the lathe spindle are exceptions to this rule. They are specially designed with six slots and they fit into a special attachment screwed to the nose of the lathe spindle. This method dispenses with the necessity for a drawbar.

When you have decided to make these accessories, the first thing to consider is what method of operation to adopt. To have one similar to that illustrated in Fig. 2, the size of collets and drawbar will be determined by the bore in the lathe spindle.

On small lathes which have a No 1 Morse taper in the nose of the spindle the range of collet sizes will be limited, but the limitation can be overcome to some extent by boring the taper in the nose of the spindle and fitting the collet direct. There must be sufficient metal to allow this. Those who have a Portass, Zyto or EW lathe should not find any difficulty. If this method is decided on, I would suggest an included angle of 20 deg. so as to leave the nose of the spindle as strong as possible. A further alternative, still using a drawbar, is to make an adaptor similar to the one illustrated, but screwing on to the nose of the spindle. Some of the advantage of keeping the work close to the spindle is lost, but not enough to prevent it from working satisfactorily.

The other methods which I will deal with in turn are the same as these except they they dispense with the drawbar. This will suit those lathes that do not have the spindle bored right through. The adaptor is screwed to the nose of the spindle and the collets are operated by knurled or hexagon cap.

● *To be continued*

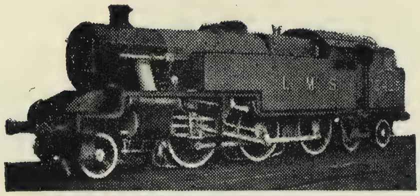
PERCIVAL MARSHALL PLANS SERVICE

WE5 Power-driven hacksaw machine

A VERY useful piece of equipment in any home workshop would be the inclusion of a power hacksaw machine. This luxury is placed in easy reach of the amateur by Duplex, who has designed a sturdy and inexpensive machine specially catering for his needs. The drawings, of which there are two to a set, are easy to read, giving each detail in a straightforward manner. The approximate overall dimensions are: length 18 in., width 9 in. and height 12 in.

Sheet 1: general arrangement and full details of all the parts required; **Sheet** 2: pinion and gear wheel, wiring diagram, guard for gears and details of crank and carriage assembly. Price, post paid, 10s. 6d. USA and Canada, $1.50.

Readers who wish the drawings to be sent by airmail should add the following amounts: Australia and New Zealand, 5s. 3d.; Canada, USA and South Africa, 4s. 6d.



MARTIN EVANS considers the design of full-size coupling rods and deals with those for the $3\frac{1}{2}$ in. gauge locomotive

JUBILEE

Coupling rods

Continued from 17 July 1958, pages 70 to 72

THIS week's article deals with one of the most interesting of the mechanical details of the locomotive—the coupling rods—so before considering the construction of the rods for the model, we might discuss the design of the full-size components.

On most locomotives today, the coupling rods are fluted very deeply both front and back; to take an extreme case, the LNER A4 class use rods of width and thickness (halfway between crankpins) 5 in. $\times$ $2\frac{1}{2}$ in.; yet the fluting is so deep that the thickness of the rod in the centre part is only $\frac{3}{8}$ in. ! This has been made possible by the use of very high grade nickel-chrome steel. However, in the case of the LMS 2-6-4 tank locomotives, non-fluted coupling rods are used, and these have a cross-section in the middle of $4\frac{7}{8}$ in. $\times$ $1\frac{3}{8}$ in.

If made exactly to scale then our coupling rods would have a cross-section approximately $\frac{5}{16}$ in. $\times$ 7/64 in. We can safely adopt the former dimension but 7/64 in. is cutting things a bit fine and for a strong working job I suggest 5/32 in.

Most full-size coupling rods use bronze bushes lined with white metal at each crankpin, and the knuckle-joint may be either bronze-bushed or have a case-hardened steel bush.

The bronze bushes are pressed in and keyed and in some engines, locking screws are used in addition. Lubrication is taken care of by oil-boxes formed in the material of the rods themselves. As the coupling rods revolve, the oil is thrown upwards inside the oilbox and passes down into the oilhole through a fluted plug at the entrance, which restricts the quantity of oil that can pass.

A felt pad occupies a groove in the bush at the bottom of the oil-hole and this rubs on the surface of the crankpin, thus lubricating it. An advantage of the use of the felt pad is that any grit which may enter the oilbox with the oil cannot pass through the felt on to the surface of the crankpin.

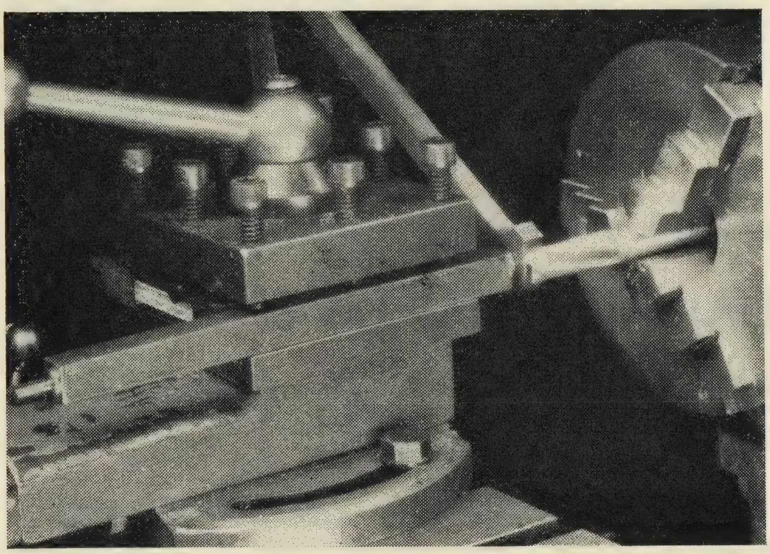
In some designs, an oilbox is also provided for the knuckle-joint, but as this does not have such heavy wear as the main points, very often this is omitted and a plain oil nipple for the driver's oil can is provided instead.

The pin in the knuckle-joint may have a tapered head on the inside and be tapered again on its outer end, that is to say on the outer limb of the front rod, a washer, castle-nut and split pin being provided on the outside; on our prototype the pin is parallel throughout, with a plain head on the inside bearing partly in the rod and a plain collar on the outside; the pin itself being bored and a fixing bolt put through the lot.

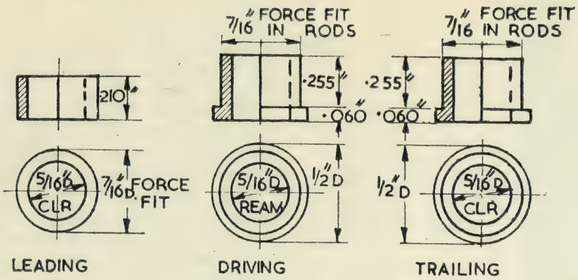
In a $\frac{3}{4}$ in. scale job a tapered head is useful, flush with the back of the rod, as we have not very much clearance here, while a 6 BA hexagon nut and washer will suffice to hold the pin firmly.

Referring to the coupling rod bushes again, some recent designs have specified grease lubrication together with two bushes, the outer one being of nickel-chrome cast iron and pressed into the rod. The inner bush is phosphor-bronze and allowed to float in the outer one.

A grease nipple at the bottom of the grease box is screwed through into the outer (fixed) bush which has grooves cut circumferentially on the inside. The floating bush has a



Shaping the bosses of the coupling rods



BUSHES FOR COUPLING RODS 2 OFF EACH PH.BRONZE

series of grooves in it to enable grease to reach the crankpin, and also a large number of countersunk holes which assist in the distribution of the grease to the working surfaces. Grease lubricated rods of this type give mileages of the order of 100,000 before renewal is necessary, a figure which may make some i.c. fans sit up and take notice !

In the case of the model coupling rods, the usual practice is to ream the driving bushes to give a close working fit on the main crankpin and to drill the leading and trailing bushes 5 to 15 thou larger than the nominal diameter to allow for slight irregularities in the track.

As a matter of interest, it is now customary in modern locomotive practice to allow a clearance of 0.005 to 0.008 in. for driving crankpins and about 1/32 in. for leading and trailing crankpins on a six-coupled engine.

Coming now to the coupling rods, about 30 in. of $\frac{3}{4}$ in. × $\frac{1}{4}$ in. bright mild steel will be required. Stainless steel can be used but it is very much harder to work for such a small advantage in strength and rust-resisting properties. The first thing to do is to clean up enough of the bar to make, say, the left-hand rods and coat with a marking-out fluid. A horizontal centre line is then scribed right along at a distance of $\frac{5}{16}$ in. from the bottom edge.

To ensure correct centres for the crankpin my usual method is to use a large pair of dividers and set these from the actual job, applying the points of the dividers to one side of the axle rather than the centre and checking on both sides of the chassis just in case there is any difference (there *shouldn't* be !).

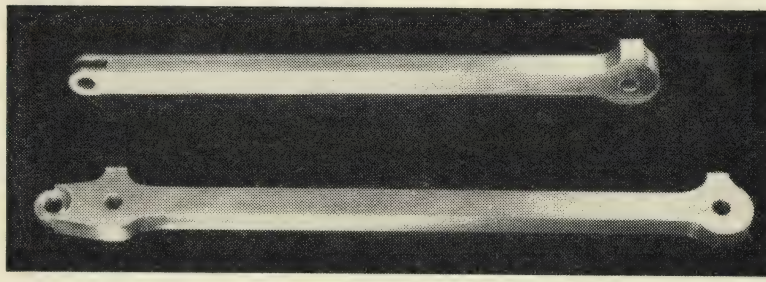
The dividers are then used to scribe the vertical centre lines of the bosses, while the position of the knuckle-joint is set out most carefully as, of course, any error made here would upset the spacing of the rear part of the coupling rods.

Centre punch the intersections checking the centres so formed with a jeweller's glass if you have one (and most useful they are too), then set out the radii of the bosses and the outline of the oilboxes, and finally the parallel sides of the main part of the rods between the bosses. Drill and ream the five holes $\frac{3}{16}$ in. dia. at this stage, then bolt the pairs together with 2 BA screws or, better still, use $\frac{3}{16}$ in. dia. copper snaphead rivets.

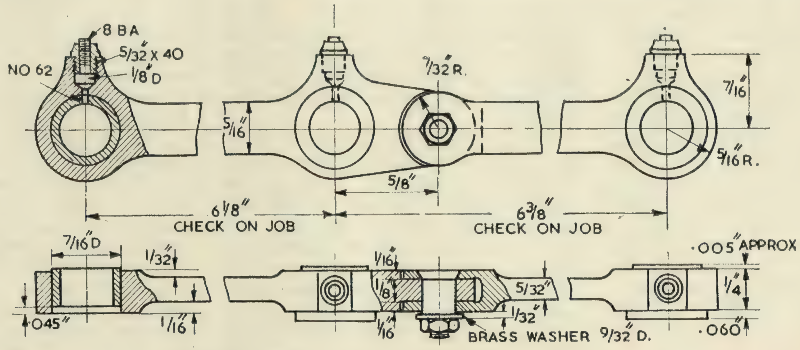
Now comes the heavy part of the work, though naturally anyone who is fortunate enough to own or have the use of a large horizontal milling machine will find nothing heavy about it, using a slab milling cutter of fairly small diameter to remove the unwanted metal.

Lathe owners having a substantial vertical slide and machine vice, and a fair length of travel on the cross slide, can do the job using an end-mill about $\frac{1}{2}$ in. dia. However, in the average small lathe, this method takes quite a time and anyone not afraid of a bit of hacksawing can do just as well with nothing more than the bench vice. You will need a 12 in. h.s.s. blade and plenty of files; starting the filing with a 10 in. or 8 in. flat second-cut.

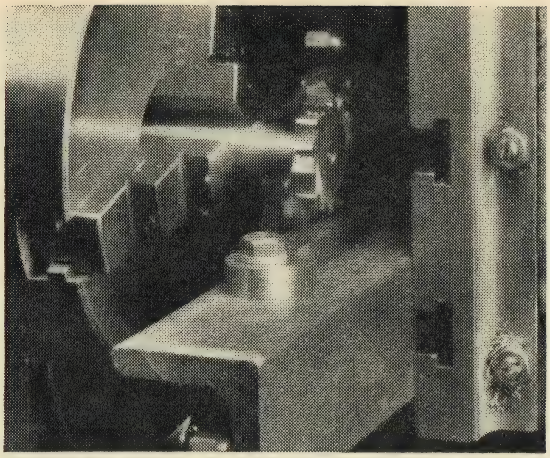
Just a point though, a section of metal must be removed by drilling and filing with a square file to enable the hacksaw blade to saw along the



Illustrating the knuckle-joints of partly-finished rods



COUPLING RODS L.H & R.H. L H DRAWN



Milling the face of the coupling rods

scribed line. Note also that about halfway through the cut, with this size of coupling rod, the blade must be set at right angles to enable the back of the frame to clear the top of the rod blanks.

I did my own rods this way, and although the temperature at the time was in the eighties, it could have been worse! Incidentally, I find it easier when cleaning up with the file to put in the radii next the bosses before filing the straight parts.

Rounding off the bosses

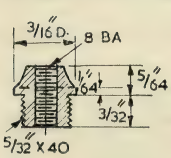
The next stage is to separate the pairs of rods and mill or file the front and back of each section to reduce the thickness to 5/32 in. My photograph shows clearly how this can be done in the lathe using a Woodruffe or face cutter of any width from $\frac{1}{8}$ in. to $\frac{1}{2}$ in. On a powerful lathe with a rigid set-up, it can be done in one cut, using a wider cutter. Do not forget though to support the middle of each rod when it is turned over, otherwise it will bend under the strain and cause chatter as well.

Failing any suitable method of milling, filing can be resorted to, and once again, it's almost as quick.

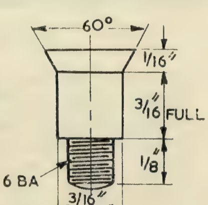
Rounding off the bosses was done by the well-known method of swinging the rod on a peg ($\frac{3}{16}$ in. dia. in this case) turned on the end of a piece of square b.m.s. bar which was clamped under the lathe toolholder at centre-height. The rod is swung by hand against an endmill of $\frac{3}{8}$ in. dia. held in the three-jaw chuck or a collet; this will give a nice true radius right up to the oilbox. It is advisable to take a firm grip of the rod and to swing it against the rotation of the cutter as far as practicable because if the cutter "takes charge" a rod could be spoiled in a matter of seconds.

Coming now to the knuckle-joint, the slot in the rear rods can easily be cut with a slotting or face cutter $\frac{1}{8}$ in. thick, mounted on an arbor between centres, the rod itself being clamped under the toolholder at centre-height and square to the arbor. Take the cutter in at low speed, with plenty of cutting oil, and allow it to penetrate far enough to give a little clearance for the "tongue" on the fore rod. The latter is machined out with a pin-drill or counterbore, the body diameter of which should be $\frac{7}{16}$ in. while the guide pin must be $\frac{3}{16}$ in. dia.

I find the easiest way to do the pin-drilling is in the lathe, the pin-drill being held in the three-jaw and run



OIL BOX CAP
6 OFF BRASS



PIN —BMS
C.HARDEN
2 OFF

at lowest speed, while the rod is held firmly by the left hand, the other hand applying the pressure via the tailstock barrel, a parallel strip of hardwood being interposed between the two.

The cutter should remove $\frac{1}{16}$ in. from each side, leaving $\frac{1}{8}$ in. for the "tongue" which can, of course, be checked against the slot in the rear rod. A little side-play here does not matter at all as long as the pin is a good fit. As a matter of fact several full-size locomotives have been provided with vertical knuckle-joints in addition to the more usual horizontal type—to assist in taking curves; well-known examples being the ex-GER 4-6-0s, the GWR Krugers and Churchward's first 2-8-0s.

A trial should now be made to fit the coupling rods, so drill or ream the six bosses $\frac{5}{16}$ in. dia. and make up and fit the joint pins. These latter could be turned from $\frac{1}{2}$ in. dia. bright mild steel and case-hardened when a nice fit has been obtained—put a nut on the thread before hardening.

Pack up the main axleboxes on the chassis to running position and try the rods in place. If they won't go on at all, it should soon be evident where the fault lies. If they go on all right but show a tight spot when the wheels are rotated, a bright mark will soon show up where the pins are tight, and in either case the holes in the rods can be "drawn over" with a small round file and then opened out and reamed to $\frac{7}{16}$ in. dia.

The bushes

The bushes are all straightforward turning jobs, phosphor-bronze being used, either cast or drawn. Make sure that they are tight in the rods and project a few thou on the inside, this gives smoother running than a flush bush. If there is any doubt about their tightness—copy full-size practice and fit a locking screw vertically underneath.

Lubrication can be taken care of by drilling out the oilboxes with $\frac{1}{8}$ in. dia drill, then right through into the bore with No 62, finally fitting a brass cap as shown. The full-size engines I believe originally used a short piece of cane to keep the dirt out of the top cap, but when I examined an engine at Euston the other day, the item appeared to be of cork—perhaps some reader could confirm this?

In the next article I will be tackling the eccentric straps for the twin pumps—no, I hadn't forgotten them—I wanted to leave the drivers quite free while I fitted the side rods!

● *To be continued on August* 14

ME EXHIBITION TO BE TELEVISED

THIS year's Model Engineer Exhibition (New Horticultural Hall, August 20-30) is to be the subject of a television programme radiated by Associated Rediffusion.

The programme, which will be broadcast live, will be transmitted at 5-5.30 p.m. on Tuesday, August 26, and will give a brief but complete coverage of the models, stands, demonstrations and track events.

It is hoped that there will be time for Roy Martin, in charge of the ships' tank, A. Adams, on the diesel racing car track, and W. A. Carter, supervising the live steam railway, to show what they can do.

POSTBAG

The Editor welcomes letters for these columns, but they must be brief. Photographs are invited which illustrate points of interest raised by the writer

STINKWOOD

SIR—Regarding Vulcan's reference to stinkwood [Smoke Rings, July 10] I would like to inform him that the wood is supposed to have acquired its name from its smell when sawn.

It occurs in the forests of Knysna, 100 miles or so from Cape Town, which lie on the road to Port Elizabeth, and which, because of the beauty of its scenery during a large part of its extent, is called the Garden Route.

The forests are carefully protected as the wood is limited in its availability. It is very expensive, though it is used for high-class furniture. I spent some years in S. Africa and have now at home a 12 in. dia. bowl turned from stinkwood.

There is said to be another variety in a certain part of the Eastern Transvaal but it is much lighter in colour though it has a beautiful grain.

I understand that cutting of stinkwood trees is now prohobited by law and that the price of what is still available is something like £12 per cube !

Fawkham, Kent. K. STOCKER.

EARLY USA ENGINES

SIR,—Mr A. M. Balling is not quite correct in his facts concerning the two vertical boilered locomotives illustrated in the issue of July 10, page 61. Referring to the locomotive on the left, the *Tom Thumb*, the United States National Museum Bulletin No 210 (Smithsonian Institute, Washington) states, page 22, " No original parts remain of one of the best known early locomotives. A full-sized operable replica, however, was made in 1926 by the B & O Railroad Co. for their exhibit that year at the Philadelphia Sesqui-Centennial International Exposition." Mr Balling's photograph shows this full-size replica of 1926. It is usually housed in the B & O Transportation Museum in Baltimore but has been exhibited in other parts of the United States on various occasions.

As regards the second photograph, the *Atlantic*, this is indeed an early locomotive but its identity is a trifle involved. It is actually the B & O *Andrew Jackson* of 1836. It was in service as a shunting engine in Baltimore until 1892 when it was withdrawn from service to be exhibited at the World's Columbian Exposition in the following year. It was desired, however, to exhibit a representative of the earlier grasshopper type of 1832 so the *Andrew Jackson* was altered and dressed up to represent Davis and Garner's *Atlantic*. It has remained in the modified form to this day.

London W1. JOHN H. AHERN.

CLUB LOCOMOTIVE

SIR,—I must write to register my surprise in finding my photograph gracing the cover of MODEL ENGINEER for July 3. You state this shows me driving my own 5 in. gauge Atlantic. Unfortunately that is not quite correct for *Firefly* is a Chingford and District club's locomotive, a gem to drive at that.

London E17. J. LAWRENCE.

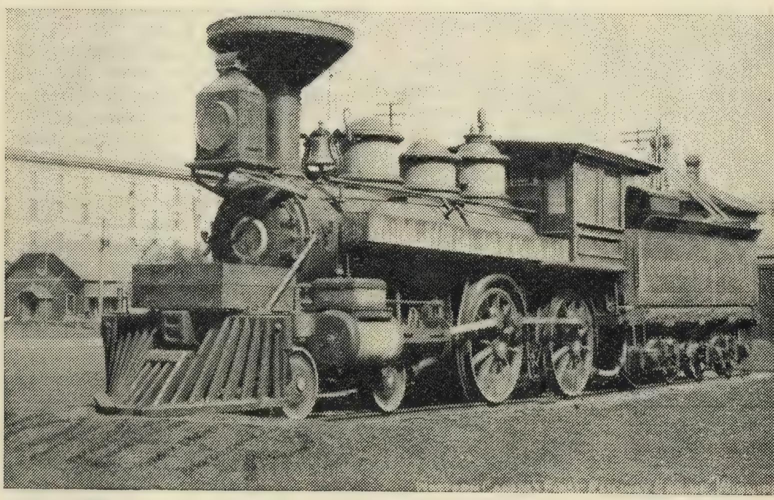
THOSE DIESELS

SIR,—I feel that my position must be well-nigh unique. I am steam by birth and upbringing. I was working on diesel engines prior to the first world war when air injection engines were the only ones made. From there I went on to steam locomotive construction in a managerial capacity much to the horror of those who felt that unless one was born in a smokebox the mysteries of locomotive building were a sealed book.

After a short period in the PBI during the first war I went on to steam ploughing, threshing and timber hauling and from there to applying the Sentinel power unit to locomotives and agricultural tractors. I then went on to diesel locomotive design and construction and after that I concentrated on marine diesel engines and more or less kept in touch with this until I went into HM Navy in 1941 and was released in October 1945. For the last three years I was base engineer officer at the largest base concerned with the refitting of the LCT's, each of which was powered by two 500 h.p. 12-cylinder engines. No less than 1,016 major landing craft of all types passed through the base for refitting in three years and every bit of work was undertaken by Service personnel.

I am fully conscious that the steam locomotive fascinates me, as it always has, but I am equally conscious that properly administered the diesel locomotive is the better tool viewed simply from the point of view of cost of transporting goods and passengers. If the lessons learned during the war concerning the maintenance of oil engines are applied to oil engines on locomotives the results will be satisfactory.

In the case of the 500 b.h.p. engines



The COUNTESS OF DUFFERIN, *Western Canada's first locomotive. Mr H. G. Evans, of Bath, Somerset unearthed this fine photograph while rummaging through old papers*

in the LCTs, these were changed every 2,000 hours whether they required it or not. If locomotive design and running shed facilities are so arranged it should be possible to change engines in a day. We were required in the case of LCTs to completely refit a craft including changing engines in a crowded harbour, inside eight days, and regularly did it in four days.

Devizes, Wilts. KYRLE W. WILLANS.

SOUTH AFRICAN MODEL

SIR,—The two photographs are of my latest locomotive, a 3½ in. gauge South African Railways 15F.

This model so far has taken me 2½ years. It has cost me not a penny. It has 2 in. × 2⅝ in. cylinders, fabricated from scrap steel, with cast iron liners. Piston and piston valves are of cast iron; piston valve dia. is 1 in. and has two rings per head with stainless steel rods. Cylinders have bypasses and snifters made of bronze.

Mainframes are cut from ⅜ in. scrap plate, and are 3 ft 10 in. long. Bogey frames were cut from ¼ in. plate, all the frames being cut by hand and drilled with a ¼ in. pistol grip machine.

Wheels were cast with steel tyres. I made the patterns for them and a friend had them cast for me.

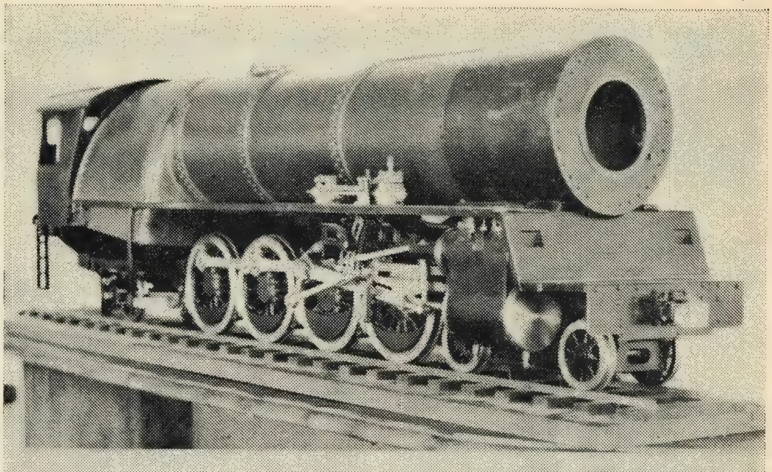
Springs were made out of old compression strip valves, and they are compensated from leading to trailing bogey. Brake gear is also compensated.

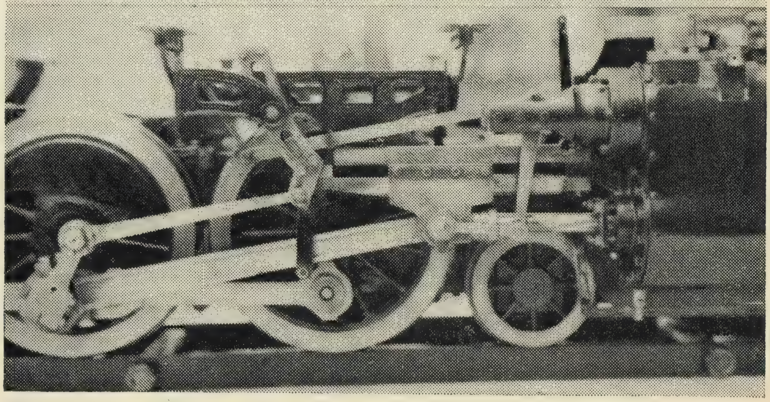
Side rods and connecting rods were cut by hand and the flutes were cut in my lathe. The valve gear was designed by me with taper pins to hold the main pins

This engine has two very highly commended diplomas of merit from the Rand Society of Model Engineers.

The engine is 4 ft 3 in. long but will be 6 ft 4 in. with tender. She is 13 in. high, 10 in. wide and has 5 in. dia. drivers, 2½ in. dia. front bogey wheels, and 2⅞ in. trailing and tender wheels.

Transvaal, S. Africa. P. G. RICHARDS.





The 4-8-2 3½ in. gauge model of South African Railways class 15F which has already won a diploma of merit for its builder Mr P. G. Richards

STEAM ECONOMICS

SIR,—I would like to raise a couple of points concerning Methanide's article [July 10] on the possibility of steam cars rivalling their internal combustion engined counterparts.

First, I think the statement that a steam car only goes half as far as a petrol car on a gallon of fuel is pessimistic. A modern steam car will do better than this and a choice of fuels if available might even make the steamer more economical than a petrol car in some cases.

This, however, leads to the second and most important point that not even steam enthusiasts really believe: that the steam car in its present form will ever rival the i.c. car—too much water has flowed under Longbridge since 1918 !

However if steam cars are produced on a large scale commercially they will undoubtedly be liquid-fired because Mr Family Motorist will not much like a car which, though possessing the attractive feature of two-pedal control, requires continuous use of a shovel.

Forest Hill, London SE23. D. WEDGWOOD.

GAUGE O AND GAUGE 1

SIR,—I must say " Thank you " for the recent articles by Martin Cleeve and by Exactus on the EW Lathe (I am the satisfied owner of No 810) and also on the brazing hearth and forge.

Like Mr Dobbs [Postbag, June 5] I have only a small lathe, a precision drill (made by the Picador people), and the usual hand tools. While I should not like to build a Beyer-Garratt in O gauge, I would not worry in the least about building it in gauge 1, but I would prefer mine to be a real miniature locomotive, with double-acting, piston-valve cylinders and Walschaerts valve gear.

I would suggest to Mr Dobbs that he used the works of *Dot* as the basis (blueprints still available according to an ME list I have) and designed a boiler to suit.

I do not quite agree with Mr H. E. Rendall [Postbag, June 12] that *Bat*, *Sir Morris* or *Mollyette* are suitable for children. My own experience suggests that electric powered, steam-outline locomotives suit children until they are 12, then follows a time when stationary engines join the former, until at about 16 years the young are able to appreciate the details and

the power of the small LBSC locomotives, especially if they are encouraged to take a hand in the building.

Now that my son has grown up, I hope to put a gauge 1 railway round the garden, with a miniature of each of Maunsell's and Wainwright's designs to run on it. Wouldn't I like to see a miniature *Lord Nelson* hauling an Atlantic Coast Express at a scale 60 m.p.h. plus or a D class hauling a Continental boat train. Perhaps, one day, I shall !

Twickenham, Middx. W. CARSFORD JUPE.

HIS FIRST EFFORT

SIR,—I made the monocular described in the Diamond Jubilee issue, as a first attempt at any metal model making. Presumably because it was a first attempt I was delighted and amazed when it worked, and worked very well too. I've had a lot of enjoyment looking at the craters visible on the bottom of the moon as well as the various bright spots thereon.

There is one suggestion I would make, that the 0.456 in. dimension of the eyepiece cell be increased to about 0.54 in. My eyepiece cell retainer protrudes about 3/32 in. due to the thickness of the eyepiece lens.

Haybridge, Salop. F. R. BORDERS.

SPEED OF A SAW

SIR,—I have a strong desire to cross swords with Martin Cleeve over his suggestion to run a 4 in. $\times$ $\frac{1}{16}$ in. saw at 100 r.p.m. This, if my arithmetic is correct, comes out at about 105 ft p.m., which I consider to be far too high, at any rate for ferrous materials. For non-ferrous, yes, but not otherwise.

Personally, I would not run any high-speed steel cutter at more than 65-70 ft. p.m. on steel or cast iron. Over 20 years experience of machine shop practice has taught me that anything much over that is liable to do a cutter no good at all.

That is the general opinion of other milling machine operators with whom I have discussed this question, so my advice would be to keep the speeds down to reasonable levels, and leave the racing to carbides.

Felling-on-Tyne, Gateshead. R. MORRIS.

NAMES TO REMEMBER

SIR,—As a reader from volume 54 I would like to offer my congratulations and best wishes for the future on attaining your Diamond Jubilee.

Mr K. N. Harris's letter [May 8] sums up the ME's achievements perfectly, except for his remarks on miniature locomotive efficiencies, particularly when applied to engines up to 5 in. gauge. I will agree the improvements have not been so spectacular as those in other fields but they are there just the same.

To mention just a few of your writers who have contributed to this, such names as LBSC, C. M. Keiller, J. N. Maskelyne, G. Willoughby and K. N. Harris immediately come to my mind, each in one way or another having added to the information available today that makes miniature locomotive performance what it is.

Maidenhead, Berks. D. T. WEBSTER.

GERMAN MODELS

SIR,—Concerning the letter from H. E. Rendall [Postbag, June 12], about 1902 I was in charge of the maintenance dept. at the Northampton Electric Light and Power Company and we used to draw our sundry items of stores from the works of J. T. Lowkes. I was on quite friendly terms with the late Mr Bassett-Lowke who was at that time about the same age as myself, 22.

The Lowkes company ran a general engineering works, and also overhauled portable and ploughing engines, and I well remember seeing one man cut a firehole about 8 in. $\times$ 6 in. $\times$ $\frac{1}{2}$ in. in the front plate of a portable boiler with a cross-cut chisel and hammer. He started at a hole and took cuts about $\frac{1}{16}$ in. thick $\times$ $\frac{3}{8}$ in. wide, at about 30 deg. between two scribed lines, not forgetting to wipe his chisel on a piece of oily rag before each cut. I do not know how long it took to go round the firehole but he was making a fine job of it.

Mr Bassett-Lowke used to make frequent journeys to Nuremberg to collect samples of model engines, which I understood were manufactured in a cartridge factory. Some were electric models, which were powered by accumulators, and these he would hand over to me for test and report and for recharging.

I note you are making a photographic tour of the South Kensington Science Museum; there is installed there a 1/5th scale working model of the Meco Moore Coal Cutter Loader. This was made by Gaywood Fish and Sons and is well worth noting.

The Jubilee Number of ME was a great success. I sent two copies to Canadian engineering friends of mine at Galt, Ontario and Vancouver, BC.

Worcester. L. GAYWOOD FISH.

THE ATALANTA

SIR,—Jason is in error. The builders of the *Atalanta* were not T. White, but the world-famous shipbuilders John Samuel White Ltd. This firm were the builders of many famous ships, including the destroyers *Faulkner*, *Tipperary* and *Broke*, which gave such good accounts of themselves during the 1914-1918 world war.

This firm, which is still going strong, were responsible for some very early examples of prefabrication, having built stern-wheelers for use on the Nile and many other foreign rivers. These ships were built at Cowes, they ran trials, and were then dismantled for transport and reassembled in remote corners of the world. I think I am correct in saying that they also built the first experimental set of engines resulting in the combination of reciprocating engines with turbines running on the exhaust from the former, a principle afterwards adopted in the ill-fated *Titanic* and her sister ship *Olympic*.

I witnessed the departure of the *Titanic*, from Cowes esplanade, and also worked on the *Olympic* many years later, fitting new crankshafts to the main engines. The crankshafts weighed 100 tons each and each crank web had balance weights of 5 and 7½ tons each !

It is ancient history that the port of Cowes with its Royal Yacht Squadron was also a very popular place with Queen Victoria and I remember the yachts which were used in those days. A paddle steamer called the *Alberta* used to land the Queen at the landing stage at East Cowes. This vessel had two funnels, bell-mouthed at the top. The gold leaf decor at the bow and stern was worth a fortune.

This vessel bore the body of the dead Queen from East Cowes to Portsmouth on the funeral journey. The *Osborne* was another ship used by the Queen at that period; this also was a fine looking ship, and together with the old Admiralty Yacht, *Enchantress*, they make a very imposing sight.

Southampton. CHAS. J. MILLMORE.

PANSY IN 3½ in. GAUGE

continued from page 148

Anyway, to cut a long story short (if I described the job in full, it would need another instalment) I rebuilt it as a coal-fired passenger-hauler, using as much of the existing material as was possible. Bill was delighted when he came to my old home at Norbury and drove it on my up-and-down straight line. He took it away, and duly ran it on the SMEE track, and at the ME Exhibitions, but it required a lot of maintenance, both materials and design being poor. I often wondered what became of it after his untimely end through the accident at Huntingdon, and I was rather surprised to hear that it was still in existence.

● *To be continued*

LBSC writes every week

READERS' QUERIES

This free advice service is open to all readers. Queries must be of a practical nature on subjects within the scope of this journal. The replies published are extracts from fuller replies sent through the post: queries must not be sent with any other communications: valuations of models, or advice on selling, cannot be given: stamped addressed envelope with each query. Mark envelope clearly "Query," Model Engineer, 19-20 Noel Street, London W1.

DO NOT FORGET THE QUERY COUPON ON THE LAST PAGE OF THIS ISSUE

Photographic trimmer

I am now constructing a photographic print trimmer to assist me with my work. As you will most likely know, the latest method is to print all the negatives on one strip of paper. Then, after being processed, they are cut up into single prints. My aim is to work the trimmer electrically, through the action of a solenoid, and I would appreciate it if you could inform me of the size, the amount of wire, and the gauge which would be required to wind the solenoid. On testing another trimmer with a spring balance, the pull required was about 12 lb. and the movement $\frac{3}{8}$ in. I would like the solenoid to work direct off the mains, which are 250 volts a.c.—D.B., Whitley Bay.

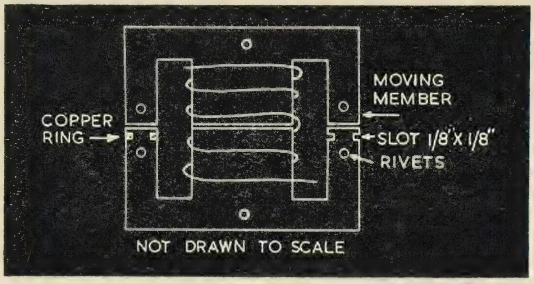
▲ *A solenoid to operate on an a.c. supply on the lines you have set out is impracticable. For a.c. working, the whole of the magnetic system must be laminated. For these solenoids the stampings have to be made to a special shape, and the stampings are not likely to be obtainable outside the trade. Transformer stampings could, of course, be used, but they would have to be modified to suit the ruling conditions.*

A piece of apparatus that would suit your application would be a contactor type of switch. The contactors can be found on the surplus market. Any maker of contactors would probably supply you with the necessary magnetic system without the wound coil, if you stated your needs.

The main feature of an a.c. solenoid is the provision of a shade ring round one or more of the poles. The ring is short-circuited, and creates a phase shift that holds the poles together without chatter, and at the same time provides the closure pull of the magnet.

On this page is a sketch of one style of solenoid arrangement. It could be made by using standard transformer stampings of E section. For the pull you have in mind a core area between $1\frac{1}{2}$-2 *sq. in. is necessary; a winding for a core of this section can be* 400-600 *turns of* 20 *or* 22 *s.w.g. plain enamel-covered copper wire. The faces of the pole contacts must be absolutely true, and the poles must touch with good contact when the magnet is energised. There must not be any air gap.*

The closing current of the magnet would be in the region of 3-4 *amps, but once the poles are together, the amount of current will then be only a fraction of an amp. This point you must consider so far as the micro-switch is concerned.*



Details of Prince

Can you give me any indication as to where details of deck fittings and history of *Prince* (1670) can be obtained. I have got as far as the important parts of rigging (standing and running) but I should like to make a thorough and authentic replica.—R.G.B., Kingsbridge, Devon.

▲ *An article on the history of* PRINCE *was published in the pre-war magazine "Blue Peter" for July* 1931. *This is no doubt unobtainable, but a copy could be loaned to you by arrangement.*

The Science Museum catalogue of Sailing Ships Vol. 2, *price* 6*s., gives a short history of the ship, with information as to the dimensions, rigging and armament. The museum also publishes a draught of the hull of the* PRINCE *to* $\frac{1}{4}$ *in. scale.*

*Dr R. C. Anderson's book on "*17*th Century Rigging," which we publish at* 25*s., gives detailed information of the rigging of the period. It was he who was responsible for the rigging of the model in the museum.*

5 in. GWR tank

I am contemplating building a 5 in. gauge GWR 3,100 class, 2-6-2T engine and I am wondering if you could tell me whether drawings of this engine, or a similar type, have ever been published in 5 in. gauge. If not, and assuming that I could get drawings in $2\frac{1}{2}$ in. gauge, would it be all right to double all dimensions for a 5 in. gauge?—A.F., Bristol 5.

▲ *It is not thought that any working drawings for a GWR* 2-6-2T *have ever been published in any of the gauges you mention. It would, in any case, be inadvisable to double a* $2\frac{1}{2}$ *in. gauge drawing, particularly with regard to the boiler.*

Perhaps it would be best for you to write to the Public Relations and Publicity Officer, British Railways Western Region, Paddington, requesting drawings of the engine (drawings of mainframes, cylinders, motion, pony trucks, cab, bunker, side tanks and boiler).

From these you could prepare a 5 *in. gauge working drawing. Should you have any difficulty in deciding valve gear proportions, or boiler dimensions, etc., you could approach us again.*

High-speed reverse

Can you advise me on converting a three-speed "crash" Austin Seven gearbox to give a higher reverse speed for marine use?

I have heard that it is possible to have this type of box altered to give 1-1 top speed and 1-1 reverse but on examination of the gear layout it appears to be impossible. One method could be to retain the top gear dog clutch and the layshaft driving gears and obtain reverse by chain drive from the layshaft using a second dog clutch which could only be engaged after disengaging the forward dogs.—L.J.B., London SW20.

▲ *There is no information available on converting an Austin Seven gearbox to give a higher reverse speed. It would be extremely difficult, if not impossible, to alter the ratio of the reverse gear in view of the particular disposition of the gear shafts.*

The simplest method of obtaining higher speeds in reverse would be to

add a bevel cluster gear in the transmission shaft behind the gearbox, provided that room can be found for it. This would be more compact than the chain-driven reversing gear and it would be possible to use bevel gears which can be obtained from the differential gear of the Austin Seven or any other car.

If you are doubtful as to the arrangement of the bevel cluster gear, an article on the reversing gearbox incorporating this principle appeared in the issue of the MODEL ENGINEER *for* 4 *April* 1957. *Although this deals with a very much smaller installation than you are contemplating, the principle is exactly the same.*

Seal engine

Can you please give me some data on the construction of the Seal engine. I have the plans and am building one to twice the scale of the 15 c.c. I am at a loss just at present as to how the cylinder liners are made watertight. Can you supply me with the back numbers that deal with its construction ?

I intend to put the engine in a 12 ft liner, which will be radio controlled. Will it be powerful enough with twin screws plus reversing transmission ?
—F.J.J., New Zealand.

▲ *The description of the Seal engine appeared in the issues: February* 6, *March* 6 *and* 20, *April* 3 *and* 17, *May* 1, 15 *and* 29, *June* 12 *and* 26, *July* 10 *and* 24 *and August* 7 1947.

With reference to the application of this engine to driving a 12 *ft liner, a boat of this size will require fairly considerable power to attain a good performance and it is thought that a single* 15 *c.c. Seal engine would not be sufficiently powerful. It is, however, possible to obtain drawings and castings for a* 30 *c.c. conversion of the engine, known as the Seal Major and these can be obtained from Messrs Craftsmanship Models Ltd,* 27 *Circle Gardens, Merton Park, London SW*19.

If you propose to drive twin screws it will be possible to use a transmission gearbox incorporating reversing mechanism and we hope to be able to describe a gearbox of this type in MODEL ENGINEER *in the near future.*

Fluorescent lighting

I have an 80 watt fluorescent light and I understand that with the addition of a further starter it would be possible to operate two 40 watt series tubes in lieu of the 80 watt tube. Considerable experiment has not met with success and I would be grateful for your guidance. Would it be possible to alter the phase so that the frequency of the mains would not cause synchronous effect when both tubes are used to illuminate a lathe and circular saw ?—D.W.T., Bournemouth.

▲ *It is possible to operate two* 40 *watt lamps using the same choke, but a special starting switch is necessary. It would be best if you contacted the makers of the unit who will advise you on this point. There is no specific circuit, individual units have their own characteristics.*

It is not possible for you to alter a set of lamps to avoid the stroboscopic effect; this is done by the use of two choke coils one arranged to give a leading current, the other a lagging one. It is the phase angle that is changed not the frequency. If you contact Ekco-Ensign Electric Ltd, 45 *Essex Street, Strand, London WC*2 *and ask for their catalogue* 3*Rd (edition January* 1956) *you will find practically all the likely circuits used for fluorescent lamp units.*

Suppliers of castings

I am looking for a source of supply of castings for bogies for passenger trucks in 1½ in. scale. I believe that a firm called Fenlow Products may be able to help me. Could you let me know their address ?

At the same time I should be grateful if you would inform me of a source of supply for castings for the 1 in. scale Duplex boiler feed pump described by Mr Austen-Walton some few years ago in the ME.—S.M.S., Ashover, Derbyshire.

▲ *It is not thought that Fenlow Products do castings for* 1½ *in. scale passenger truck bogies. However, their address is* 186 *Oatlands Drive, Weybridge, Surrey.*

It might be worth trying Dick Simmonds of 5 *South Road, Erith, Kent, or Summerscales, of* 18 *Highbury Grove, Cosham, Hants, for these and for castings for Duplex boiler feed pump.*

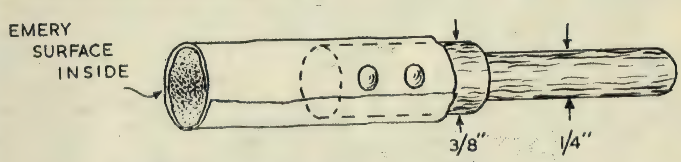
Lining up bearings

I have made up a simple angle-iron frame, with extra cross pieces, to accommodate four ⅝ in. dia. bearings. Could you please offer a suggestion as to how to line these up ? I have tried a long ⅝ in. bar, but it sags in the middle. Also it is difficult to get a straight bar of this length.—P.W.S., Chichester.

▲ *It is thought that some form of mandrel is the only practical appliance for this purpose. In order to obtain rigidity a bar of larger diameter, concentrically drilled in the ends to take ⅝ in. parallel mandrels, might be used.*

You do not mention what section of angle-iron is being used for the frame, but it is considered that unless a fairly heavy section of material is employed the rigidity of the frame itself may become quite a problem, in spite of the fitting of extra cross pieces, as it is rather difficult to strengthen a frame of this kind against twisting stresses.

READERS' HINTS



Boiler cleaning—A useful tip

During the construction of the boiler for a 7¼ in. gauge articulated tank engine I was faced with a little cleaning problem. My acid bath is a 12 in. dia. glazed pipe, but is not deep enough to immerse the whole length of the boiler, which has to be lowered into it on end. Therefore, after silver soldering the tubes into the firebox, the front ends of the tubes became blackened and dirtied, although well cleaned previously.

It was not difficult to clean the superheater flues, which were fairly rigid, but the ½ in. tubes were liable to bend if the emerycloth was used with sufficient vigour to get them clean.

I therefore got a 3 in. length of ⅜ in. dowelling, and turned down 1 in. at one end to ¼ in. dia. to fit the portable drill. Round the other end I lapped a piece of emerycloth, business side inwards, projecting about 1 in. beyond the dowelling, to which it was fastened by two drawing pins.

This was then applied with the aid of the portable drill over the end of each tube, and the 16 tube ends were cleaned very efficiently in a fewer number of minutes. E. Powell.

CLUB NEWS

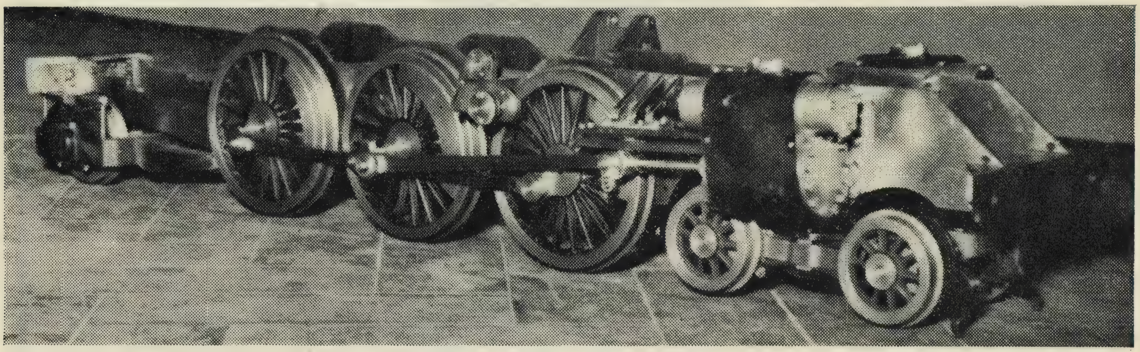
EDITED BY

THE CLUBMAN

MODEL engineers on holiday in Weymouth—or any part of lovely Dorset—towards the middle of August will want to visit the 1958 Weymouth Model Engineers' Exhibition at the Melcombe Regis School. This is the society's fifth annual exhibition and the most important of the five.

It is important because almost the entire proceeds will be used for the construction of a 500 ft multi-gauge steam track to be erected in one of the local gardens with the official co-operation of the town. Everyone who knows the public gardens of Weymouth will understand what this means, not only to the society and the resort, but also to the model engineering movement in terms of prestige and goodwill. There are many public tracks in Britain, but not all of them can be enjoyed at their best, in an ideal setting.

This is one reason why the society deserves special support in the five days from August 12 to August 16. Another reason is the sheer attractiveness of the show. Look at the picture of the 3½ in. Britannia under construction by E. G. Ellis. This is one of the exhibits. The others include a number of stationary steam engines and pumps by E. J. Linden; a 3½ in. *Princess Elizabeth* which F. H. Moysen is building; a 1 in. scale traction engine representing work in progress by W. Ford; a display of tools and lathe attachments by E. J. Smith; and a selection of components for diesel-engined racing cars by J. Marks and P. A. Strong.



If you happen to be in the Hardy country on the right dates, try your best to be at the Melcombe Regis school in Westham Road, Weymouth, between 11 a.m. and 9 p.m. on any of the five days. When you arrive introduce yourself to one of the stewards. The exhibition has a perfect secretary in John D. C. Collier of 20 Rylands Lane, Rodwell, Weymouth.

SHOWS BY THE SEA

Close to the sea in a different area of England, **Ramsgate and District MC** has been preparing its Ajax passenger railway for this summer. Secretary E. Church (14 St Mildred's Avenue, Ramsgate) mentions, among special events, a visit to Leigh Pemberton's 9 in. gauge railway at Doddington, where members are allowed to drive on a 2½ mile track, and an outing, with wives, families and friends, to the Romney, Hythe and Dymchurch Railway. Visitors are welcome from 7.30 to 9.30 on Friday evenings at the club headquarters behind Effingham Street Fire Station.

Not far from Ramsgate, the **Dover Model Club** holds its annual exhibition at the Biggin Hall on August 7 and the two days following. Exhibition manager A. G. Trice, writing from Police House, Eythorne, near Dover, says that all types of models will be on exhibition and that working demonstrations will continue for the three days.

ME DIARY

August 1 Rochdale SMEE "Boiler for Princess Marina," E. Hinchliffe, Lea Hall, 7.30 p.m.

Warrington and District MES track meeting, 7.30 p.m.

August 3 MPBA international speed regatta, St Albans, (August 3 and 4; August 2 practice).

IRCMS international regatta, East Park, Kingston-upon-Hull (August 3 and 4).

Malden and District SME track days, (August 3 and 4).

August 4 National Traction Engine Club rally, Woburn Park, Woburn, Beds.

Bristol Railway Circle president's party, Coombe Lane, 2.30-7 p.m.

August 7 Dover MC annual exhibition, Biggin Hall, Dover, (August 7-9).

August 30 Pennsylvania Live Steamers annual meet, club track near Paoli, Pennsylvania; 2½, 3½ and 4¾ in. gauges; 3½ in. gauge passing loop. (August 30-September 1, chairman, J. Harold Geissel, 125 Biddle Road, Paoli.)

VERULAMIUM'S WELCOME

In a few days from now, on August 3, the nomination events will be in progress at St Albans Regatta. There are steering and pole events for all hydroplane classes, in a programme which begins at 12.30 p.m. and continues until 6 p.m. Practice running for both speed and straight-running craft will have taken place on the previous day from 2.30 p.m.

The Bank Holiday brings the International Speed Regatta of the **Model Power Boat Association.** It lasts from 11 a.m. to 6 p.m. and provides for all classes of hydroplane.

There should be a very happy holiday gathering at the Red Lion Hotel in St Albans at eight o'clock on the Sunday evening when a dinner is held in honour of the Continental guests. French, Belgian and Italian clubs are giving full support.

P. Lambert, secretary of **St Albans MES** and chairman of the MPBA, writing from 6 Molescroft, Farm Avenue, Harpenden, Hertfordshire (Harpenden 5065) says that the event will be the largest international one of its kind ever to be held in England. Welcome, then, to Verulamium.

WRITE NOW, EAT THEN

Members' wives are being asked (not, I am sure, in vain) to provide light refreshments for the enthusiasts who are expected to visit Earlstown for the Open Day of **Warrington MES** on August 10. But how many of you will be there ? Secretary S. H. Harvey, of 55 St Mary's Road, Penketh, Warrington, would like to know so that nobody will starve.

The track is behind the British Legion Club, and Earlstown is on road A572.

Model Engineer

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Portable Power Tools. New, used, bought, sold, exchanged.—HALL DRYSDALE & CO. LTD., 58, Commerce Road, Wood Green, London, N.22. BOWes Park 7221.

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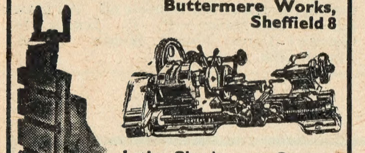

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Send 1s. P.O. for lists of workshop equipment. Electric motors, electric tools, lathe, accessories, spindles, pulleys and host of other useful items. All guaranteed. —W. MOLDON, 366, King Street, London, W.6.

Haighton Lathe 2½", 6" G.B., 8" centres, 4-jaw chuck and countershaft, as new, £12. —WEBB, 35, Woodfield Road, Solihull, Warwickshire.

Clearing Workshop. Enthusiast has much equipment for disposal: tools, material, parts, etc., too much to list. State wants.—Box, No. 8964, MODEL ENGINEER Offices.

Wanted. Taper Turning Attachment for Little John lathe.—32, Central Ave., Pinner. Pinner 6805.

Brand New Tools. Assorted taps 2-12 B.A., 9s. 6d. doz. Hand thread chasers, mixed, 5s. 6d. doz. Precision needle files, 9s. 6d. doz. Assorted 4" files, 10s. 6d. doz. H.S.S. small circular milling cutters, 6 for 12s.—A. KING, 152, Halfway Street, Sidcup, Kent.

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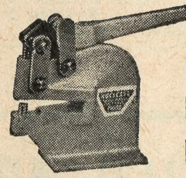

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ME QUERY COUPON JULY 1958

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